G17.8-06

ams
2

Library
of the
Academy of Medicine,
Toronto.
10329
Presented by
R. A. Reeve Fund
1919
VIS Ser. 1 ch

TRANSACTIONS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

EIGHTH ANNUAL MEETING.

NEWPORT, R. I., JULY 21, 1875.

Vol. 2. Part 1.

LIBRARY
JUL 1 8 2002
UNIVERSITY OF TORONTO

BOSTON:
FOR SALE BY JAMES CAMPBELL, 18 TREMONT ST.
1875.

BOSTON:
ALFRED MUDGE AND SON, PRINTERS.
34 SCHOOL STREET.

CONTENTS.

	PAGE
Members of the Society	5
Minutes of the Eighth Annual Meeting	7
Report on Otology. By C. J. Blake, M. D., and A. Mathewson, M. D.	13
Eustachian Bougies. By A. H. Buck, M. D.	64
Intra-Tympanic Pressure during Phonation. By C. J. Blake, M. D.	75
Angioma of the Lobule of the Ear. By C. J. Kipp, M. D.	79
Aural Contributions. By George Strawbridge, M. D.	81
Multiple Abscess of Auricle. By O. D. Pomeroy, M. D.	83
Otitis Media Hemorrhagica. By O. D. Pomeroy, M. D.	86
Remarks upon the Early Treatment of Ear Affections. By D. B. St. J. Roosa, M. D.	87
A Case of Purulent Infection (Pleuro-Pneumonia), from Suppuration of the Middle Ear. By D. B. St. J. Roosa, M. D.	90
Experiments on the Effects of Quinine upon the Ear. By D. B. St. J. Roosa, M. D.	93

10329

MEMBERS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

HONORARY MEMBERS.

PROF. EDWARD H. CLARKE, M. D. . . . . Boston, Mass.
PROF. ALFRED D. MAYER . . . . . Hoboken, N. Y.
PROF. OGDEN N. ROOD . . . . . New York, N. Y.

MEMBERS.

DR. FRANK W. ABBOTT . . . . . Buffalo, N. Y.
DR. CORNELIUS R. AGNEW . . . . . New York, N. Y.
DR. EDWIN W. BARTLETT . . . . . Milwaukee, Wis.
DR. ROBERT M. BERTOLET . . . . . Philadelphia, Pa.
DR. CLARENCE J. BLAKE . . . . . Boston, Mass.
DR. ALBERT H. BUCK . . . . . New York, N. Y.
DR. CHARLES H. BURNETT . . . . . Philadelphia, Pa.
DR. JOHN H. DIX . . . . . Boston, Mass.
DR. EZRA DYER . . . . . Pittsburg, Pa.
DR. RUDOLPH GEBSER . . . . . New York, N. Y.
DR. JOHN GREEN . . . . . St. Louis, Mo.
DR. J. ORNE GREEN . . . . . Boston, Mass.
DR. EMIL GRÜNING . . . . . New York, N. Y.
DR. J. H. HINTON . . . . . New York, N. Y.
DR. EDWARD L. HOLMES . . . . . Chicago, Ill.
DR. SAMUEL J. JONES . . . . . Chicago, Ill.
DR. CHARLES J. KIPP . . . . . Newark, N. J.
DR. HERMAN KNAPP . . . . . New York, N. Y.
DR. WILLIAM S. LUDLUM . . . . . New York, N. Y.
DR. ARTHUR MATHEWSON . . . . . Brooklyn, N. Y.
DR. C. S. MERRILL . . . . . Albany, N. Y.
DR. H. G. MILLER . . . . . Providence, R. I.
DR. WILLIAM W. MORLAND . . . . . Boston, Mass.

Dr. H. G. Newton . . . . . Los Angeles, Cal.
Dr. Henry D. Noyes . . . . . New York, N. Y.
Dr. J. F. Noyes . . . . . Detroit, Mich.
Dr. Charles I. Pardee . . . . . New York, N. Y.
Dr. Howard Pinkney . . . . . New York, N. Y.
Dr. George B. Pomeroy . . . . . New York, N. Y.
Dr. Oren D. Pomeroy . . . . . New York, N. Y.
Dr. Thomas R. Pooley . . . . . New York, N. Y.
Dr. J. S. Prout . . . . . Brooklyn, N. Y.
Dr. William Rankin . . . . . Newark, N. J.
Dr. Charles E. Rider . . . . . Rochester, N. Y.
Dr. C. A. Robertson . . . . . Albany, N. Y.
Dr. D. B. St. John Roosa . . . . . New York, N. Y.
Dr. John D. Rushmore . . . . . Brooklyn, N. Y.
Dr. William W. Seely . . . . . Cincinnati, O.
Dr. Samuel Sexton . . . . . New York, N. Y.
Dr. Henry L. Shaw . . . . . Boston, Mass.
Dr. Francis Simrock . . . . . New York, N. Y.
Dr. Nelson B. Sizer . . . . . Brooklyn, N. Y.
Dr. H. N. Spencer . . . . . St. Louis, Mo.
Dr. George T. Stevens . . . . . Albany, N. Y.
Dr. George Strawbridge . . . . . Philadelphia, Pa.
Dr. Charles A. Todd . . . . . St. Louis, Mo.
Dr. William Thomson . . . . . Philadelphia, Pa.
Dr. J. J. B. Vermyne . . . . . New Bedford, Mass.
Dr. David Webster . . . . . New York, N. Y.
Dr. Robert Willard . . . . . Boston, Mass.
Dr. E. Williams . . . . . Cincinnati, O.

THE AMERICAN OTOLOGICAL SOCIETY.

MINUTES FOR 1875.

NEWPORT, R. I., July 21, 1875.

The Eighth Annual Meeting of the Society was opened at the Aquidneck House, at 10½ o'clock, A. M., the President, Dr. Roosa, in the Chair.

Present: —

DRS. D. B. ST. J. ROOSA	New York.
C. J. BLAKE	Boston.
WM. THOMSON	Philadelphia.
JOHN GREEN	St. Louis.
T. R. POOLEY	New York.
A. MATHEWSON	Brooklyn.
C. J. KIPP	Newark.
O. D. POMEROY	New York.
J. ORNE GREEN	Boston.
GEO. STRAWBRIDGE	Philadelphia.
J. J. B. VERMYNE	New Bedford.
E. WILLIAMS	Cincinnati.
SAMUEL SEXTON	New York.
H. G. MILLER	Providence.
C. R. AGNEW	New York.
H. N. SPENCER	St. Louis.
J. S. PROUT	Brooklyn.
J. H. DIX	Boston.
GEO. T. STEVENS	Albany.

And by invitation: —

DR. WHEELER	Newport.
PROF. GEO. F. BARKER	Philadelphia.
DR. WM. R. HALL	U. S. Army.

The President opened the meeting with a few introductory remarks on the increasing interest which is shown in Otology, and also spoke of the proposed International Otological Congress.

Drs. Agnew, Spencer, and Prout were appointed as the Executive Committee and as the Committee on Membership.

The report of the Treasurer was read and referred to Dr. Pooley, as the Auditing Committee, who reported it correct, and it was then accepted.

The Committee on Membership reported the following list of gentleman nominated as members of the Society, and on ballot they were elected: —

Drs. Horace G. Miller	Providence, R. I.
John D Rushmore	Brooklyn, N. Y.
N. B Sizer	" "
J. J. B. Vermyne	New Bedford, Mass.
Emil Grüning	New York
Rudolph Gebser	"
Wm. Rankin	Newark, N. J.
Edwin Bartlett	Milwaukee, Wis.
Chas. A. Todd	St. Louis, Mo.

The Executive Committee submitted a resolution fixing the sessions of this meeting as follows: from 10 ½ to 1 ½, from 3 to 5, and from 8 to 10 o'clock, and on motion this was adopted.

They also submitted resolutions in regard to final adjournment, and in regard to reports of public institutions with which members of the Society are connected. On motion the consideration of these two resolutions was deferred till the afternoon session.

The Executive Committee submitted a bulletin of papers, which were then read and referred to the Publishing Committee.

After the reading of the fifth paper, Dr. J. Orne Green gave notice of the amendments and alterations of the By-Laws, which would be acted upon at the afternoon session.

The Executive Committee submitted the following resolution, which was adopted : —

" *Whereas*, by an accident the report of the first meeting of the Society has not been printed ; therefore,

" *Resolved*, That the Secretary be instructed to print the same in a form to be pasted in the existing volume."

The Committee on Membership reported the name of

Dr. Saml. J. Jones . . . . . Chicago, Ill.

And on ballot he was elected.

The same committee also reported the names of the following gentlemen as nominated for honorary membership, and they were elected : —

Prof. Edward H. Clarke, M.D. . . . . Boston.
Prof. Alfred M Meyer . . . . . Hoboken, N. J.
Prof. Ogden N Rood . . . . . New York.

At $1\frac{1}{2}$ o'clock the Society adjourned.

Second Session.

At $3\frac{1}{4}$ o'clock the Society was called to order, and the reading of the remaining papers was concluded.

At 5 o'clock the Society adjourned.

Third Session.

At 8 o'clock the Society was called to order, and the minutes of the first two sessions were read and approved.

The written report of the Committee on the Revision of the Constitution and By-Laws was then read, and each section adopted, and the report as a whole adopted.

On motion of Dr. John Green, the words " of one " were also stricken from the first paragraph of the sixth section of the old By-Laws.

The following resolution, submitted by the Executive Committee at the first session, was then adopted : —

"It is recommended that printed reports of special public institutions for the treatment of diseases of the eye or ear with which members of this Society are connected, be sent by them to all their fellow-members."

The following resolution, submitted by the Executive Committee at the first session, was then considered: —

"*Resolved*, That when the Society adjourn, it adjourn to meet in New York City, on September 15, 1876, during the session of the International Otological Society; notice of the time and place of meeting to be sent to members by the Secretary of this Society."

Dr. Blake, in behalf of the committee appointed in 1873 on an International Otological Congress, submitted a report of progress, and recommended an addition of one to that committee.

On motion, Dr. J. Orne Green was added to that committee.

Dr. John Green moved the substitution of the following resolution for that of the Executive Committee: —

"*Resolved*, That the Committee on an International Congress be empowered by this Society to issue a call for an International Otological Congress at such time and place as they shall see fit," and this resolution was so substituted and adopted.

It was then moved, —

"That when this Society adjourn, it adjourn to meet at the call of its officers in 1876." Adopted.

Dr. Blake called attention to the desires of the Social Science Association to obtain the results of the examination of the ears of school-children, and said that blanks would be furnished on application to the Association.

The resignations of Drs. Hackley and Cohen were read and accepted.

The Committee on Membership reported the nomination of

DR. GEORGE T. STEVENS . . . . . Albany, N. Y.

And he was, on ballot, elected.

On motion of Dr. Blake, it was

"*Voted*, That Dr. Roosa be requested to write out his remarks urging the necessity of submitting acute diseases of the ear to treatment."

Dr. Williams called attention to the fact that the Western States felt themselves somewhat neglected in the selection of the place for the meeting of this Society.

Dr. Prout then moved and Dr. Agnew seconded the following resolution: —

"*Resolved*, That it is the sense of this Society that it will be expedient to hold the meeting of 1877 at Put-in-Bay, Ohio."

This resolution was adopted.

The Executive Committee reported the following list of officers for the ensuing year, and they were elected: —

President	Dr. D. B. St. J. Roosa.
Vice-President	Dr. Clarence J. Blake.
Secretary and Treasurer	Dr. J. Orne Green.
Publishing Committee	Dr. J. Orne Green. Dr. J. S. Prout. Dr. H. L. Shaw
Committee on Otology	Dr. C. H. Bennett. Dr. R. M. Bertolet.

The same rules as last year were adopted in regard to publishing the transactions and revision of proofs.

The minutes of this session were then read and approved.

At 10 o'clock the Society adjourned.

J. ORNE GREEN, *Secretary.*

REPORT ON THE PROGRESS OF OTOLOGY.

BY CLARENCE J. BLAKE, M. D., AND ARTHUR MATHEWSON, M. D.

The following Report on the Progress of Otology is presented, as was that of the preceding year, in two divisions,—Part I, including Anatomy and Physiology, being prepared by Dr. Blake; Part II, including Pathology and Therapeutics, by Dr. Mathewson. The bibliographical record contains the titles of papers forming the basis of the Report.

I.

ANATOMY AND PHYSIOLOGY.

At the meeting of the K. K. Gesellschaft der Aerzte, Vienna, Oct. 16, 1874, Prof. Politzer presented a communication concerning the topographical relations of that portion of the temporal bone situated between the middle ear and mastoid portion, with especial reference to the immediate relation of the musculus stapedius to the nervus facialis and the relation of both to the styloid process. In the course of his investigations Prof. Politzer discovered a number of details hitherto undescribed. In the relation of the stapedius muscle to the facial nerve, it was found in the fœtus that only the upper portion of the cavitas stapedii was separated from the facial canal by bone, the lower portion communicating freely with the canal. At this point the tissues surrounding both muscle and nerve are in contact. In the adult the relation was very varied: an entire separation of the cavitas stapedii from the facial canal, with exception of a small opening for the passage of the nervus stapedii, is rare.

On the contrary, it is very common to find in the neigh-

borhood of this opening one or more openings from 1 to 4mm. in size in the posterior wall of the cavitas stapedii, or else the lower portion of this cavity opens, by means of a rounded aperture of variable size, into the facial canal on its median wall.

The stapedius muscle appears, on longitudinal section, of a pear shape, and on cross-section, triangular, with rounded angles. The fibres arising from the sheath of the muscle extend from the floor and lateral walls of the cavity upward and towards the centre of the muscle, and pass into the tendon, which may be often traced backward as far as the middle of the muscle.

As concerns the proc. styloideus, in none of the works on Anatomy is there to be found a reference to the true origin of this process, or to the termination of its upper portion in the temporal bone.

From Politzer's investigations it appears that the styloid process originates in an individual cartilage formation, which is demonstrable as an isolated cartilaginous body, not only in the fœtus, but also in the new-born infant, and that the upper end of the process is found, not at the external visible base, but extending upward along the boundary of the external tympanic wall, and separated from the tympanic cavity by a thin, bony plate.

In the new-born infant the styloid process exhibits at its upper portion a club-shaped swelling, and below this occasionally a cartilaginous cone projecting more or less in a lateral direction. In adults the external osseous sheath of the styloid process blends more or less completely with the surrounding mass of bone.

The investigations of Prof. Moos in regard to the anatomy and physiology of the Eustachian tube, which are presented in a pamphlet of fifty-three pages illustrated by six handsome lithographic plates, were mostly made upon sections of the frozen parts. The author concludes that the Eustachian tube, when in a state of rest, is closed at a point just behind the funnel-shaped end of the faucial opening, and that the closure

extends over about two fifths of the length of the canal. On the lower surface or floor of the tube the closure is effected by the longitudinal folds of mucous membrane, which, as seen in cross-section, form a considerable prominence, literally a valve, the size of which is subject to individual variations. On the opposite surface of the canal, below the cartilaginous hook, there is found in the lower section of the canal another prominence of the mucous membrane, smaller, yet visible in section to the naked eye, the occurrence of which has been hitherto overlooked; this prominence, as well as that on the floor of the tube, acquires importance through the numerous analogues occurring in animals, and their function seems to be to facilitate the patescence of the canal by their rapid and easy unrolling.

The author, although differing essentially from previous authorities in respect to the lower segment of the canal, has presented nothing concerning the upper portion which materially contradicts previous views. A portion of the work of especial interest is that in which is further described the structure of the cartilaginous portion of the tube, and the drawings show a much greater detail in examination and description than has hitherto been accorded to the subject.

The "islands of cartilage" mentioned by Zuckerkandl* are fully described. In regard to size they are divided into those visible to the naked eye and those that are microscopic. In regard to situation they may be divided into five classes, the most important of which are those on the floor of the tube and those on its sides. The latter have greater importance histologically, as consisting always of fibro-cartilage, and physiologically, as assuming the part of actual sesamoid bones in the mechanism of the tube through their connection with the sub-mucous tissue, the fascia salpingo-pharyngea, and the tendon of the tensor veli palati. This view is supported by the fact that in the horse such a disk of cartilage is found, upon which the inner belly of the abductor tubae finds insertion. With regard to the division of the tube into

* Centralblatt, 638, 1874.

"safety tube" and "accessory fissure" the author supports his disapproval of such a division upon reasons drawn from Special and Comparative Anatomy, and gives the following explanation of the physiological action of the muscles of the tube: —

The tensor veli palati acts directly as a dilator only upon the cartilaginous hook and the neighboring membranous portion of the tube; it acts on the entire membranous portion of the tube only in cases where it is in direct anatomical relation with the sub-mucous tissue, which is not the case when the processes of the fascia salpingo-pharyngea are united with the sub-mucous tissue.

Upon the floor of the tube, and that part of the membranous wall which is not drawn away by the direct action of this muscle, it acts indirectly as an abductor tubae. The upper and middle constrictors of the pharynx furnish assistance by means of the tendinous processes of the fascia salpingo-pharyngea.*

The author furthermore rejects Rüdinger's view, that the levator veli palati assists in the dilatation of the tube, and bases his opinion upon grounds previously advanced by others, and upon arguments of his own, which are derived particularly from the pathological histology of chronic catarrh of the tube.

The appendix of five pages treats of the occurrence of ossified "islands of cartilage" in the human subject, giving the history of the case on which the observations were made, illustrated by a microscopic drawing. An examination of these structures shows a medullary space, bony substance, and periosteum, the author's view being that the new formation presents an example of the metaplastic type of ossification, a direct conversion of cartilage tissue into osseous tissue.

In pursuance of the subject of the monograph of Prof. Moos, Zuckerkandl has continued his investigations on the anatomy and physiology of the Eustachian tube, the first part of which was published in December, 1873, and reviews the

* Described by Zuckerkandl, loc. cit.

statements of that author. In preparing the ligamenta salpingo-pharyngea Zuckerkandl adheres to his former method in preference to preparation by section.

On removing the pharyngeal covering of the tube, the ligament is revealed which Moos, according to the author, has incorrectly described as the fascia salpingo-pharyngea, but which Zuckerkandl says does not correspond to the anatomical structure of a fascia. The ligament is inserted by distribution of its fibres in the perichondrium of the tube except when cartilage plates occur, when some of the fibres are distributed thereto and either terminate on the cartilage plate, thus being indirectly attached to the tube, or enclosing the cartilage plate, as it were, proceed to a more direct attachment. In eleven out of thirty-eight cases, masses of fibro-cartilage, of varying size and shape, were found imbedded in the fibres of the ligaments of the tube, each enclosed in a single fasciculus, or forming a centre for the insertion of several fibres. The presence of these fibro-cartilaginous centres, as it were, with the corresponding tendinous arrangement of the fibres, serves, according to the author, to facilitate the opening and closing of the Eustachian tube. Unquestionably the presence of a cartilaginous net-work is of considerable effect in the sudden opening of the tube during the act of deglutition. Under ordinary circumstances, a certain proportion of muscular contraction of the superior and inferior constrictors of the pharynx would be devoted to the increase of tension of the relaxed ligament; and this having been effected, the further muscular effort, in conjunction with the tensor palati mollis, abducts the walls of the tube.

If, however, a large portion of the salpingo-pharyngeal ligament is cartilaginous, the initial portion of the muscular contraction is no longer necessary to increase the tension of the parts, and the effect upon the enlargement of the tubal canal is so much the greater.

Zaufal has continued a series of investigations on the mechanism of the opening and closing of the Eustachian tube by examination into the movements of the ostium pharyngeum,

and for this purpose chooses the examination through the nose by preference, the use of the rhinoscope materially altering the proper relation of the part by its mechanical interference.

The cases affording the best opportunities for examination are those in which it is possible to introduce a long speculum reaching to the posterior portion of the nasal canal. Under these circumstances, with good illumination, it is possible to obtain a satisfactory view of the upper surface of the soft palate and the posterior and outer walls of the pharyngeal cavity. The projection of cartilage on the posterior wall of the tube is plainly visible, covered by yellowish shining mucous membrane, and projecting considerably above the surface of the pharyngeal wall; it curves upward and forward, and terminates at its anterior end in a tense fold passing downward at a right angle, and disappearing in the yellowish mucous membrane of the soft palate; between this fold and the projecting portion of the cartilage of the tube is seen a small vertical slit. With increased illumination may be seen the posterior wall of the naso-pharyngeal cavity and the fossa of Rosenmüller. The lower portion of the surface of the soft palate is also rendered visible by depressing the speculum.

During regular respiration through the nose the relation of the parts does not materially vary; the pharyngeal opening of the Eustachian tube either remains at rest or opens and closes slightly with succeeding inspiration and expiration, after a few movements coming again to a state of rest. On pronouncing the vowels, more particularly *a*, *e*, and *i*, the lower third of the anterior fold above described is flattened; the projection of cartilage moves inward and backward, and permits a clear view beyond it. The ostium pharyngeum changes its form and dimensions, — opens downwards, and forms an oblique triangle. The movements during the intonation of the consonants correspond to those belonging to the accompanying vowels, and are least marked on sounding *m* and *n*.

On coughing, the corresponding elevation of the soft palate

is accompanied by a sudden retraction of the projection of cartilage, but during Valsalvian inflation the projection moves forward. During deglutition the movements are the same as those produced by intonation of the vowels, but more energetic. It is noticeable that in all these experiments the hook of cartilage curving over the upper portion of the pharyngeal opening of the Eustachian tube remained immovable; in a few cases extension and retraction of the tongue and forcible depression of the jaw was accompanied by a slight elevation of the cartilaginous projection. Even energetic contraction of the musculus palato-pharyngeus, under stimulus of the induced current, caused no change in the dimension or form of the ostium pharyngeum. In a second article the author substantiates the above statements by further investigations conducted in the same manner.

Michel * has made the same observations in cases where the inferior turbinated bone has been destroyed by disease, and where congenital deficiency or rudimentary development permitted an unusually clear view of the naso-pharyngeal space. Zaufal employs for examination, under normal conditions, specula 10 cm. long, 1.5 to 2 cm. wide, at the outer end, and from 3 to 7 mm. wide at the inner end. These may be introduced with little more pain or discomfort than accompanies the introduction of a large Eustachian catheter. A small mirror may be placed at the inner end of the speculum, and under good illumination a deeper view of the pharyngeal opening of the Eustachian tube obtained.

Gerlach directs attention to a structural peculiarity of the mucous lining of the Eustachian tube as yet undescribed, — the occurrence of follicles in large numbers throughout the whole of the cartilaginous portion of the Eustachian tube from the commencement of the pharyngeal end to its termination at the beginning of the osseous portion; they are most frequent in the middle third of the cartilaginous tube, are but about half the size of those of other portions of the pharynx, but include nearly the whole thickness of the tubal mucous membrane.

* Berliner Klin. Wochenschrift, x, 34.

The investigations of Utz on the histology of the membranous semicircular canals were made principally by cross-sections of the canals hardened in alcohol, this means being chosen as showing not only the structure of the walls and their various layers, but also the form and size of the structures called papillæ by Rüdinger, and especially their relation to the surface from which they arise.

The results of the investigations correspond very nearly with those of Rüdinger, and may be condensed as follows:—

The membranous canals always lie upon the convex side of the osseous canals, and are retained in this position by connective tissue. The wall of the canals is, at all ages, composed of three coats,—an outer coat of connective tissue, a transparent tunica propria, and an inner epithelial coat. From the central coat grow the so-called papillæ; in the new-born infant, the surface directed towards the cavity of the canal is quite smooth, but at the age of a few months it is broken into wave-like elevations. These elevations increase with age, and at from three to four years present the appearance of the Rüdinger papillæ, and increase in size and number with the age of the subject examined. They are of every variety of form, continuous with the tunica propria, and are probably simply elevations of this membrane; their correspondence in structure also confirms this view. The inner surface is covered by pavement epithelium, the cells in the fœtus being very small and closely packed together; in the adult, on account of mechanical pressure from the elevation of the subjacent parts they are much larger; no spaces were discernible between the cells, the whole inner surface being completely covered by epithelium.

Of recent contributions in Comparative Anatomy one of the most interesting is that of Prof. Oscar Schmidt on the organ of hearing in grasshoppers. Before proceeding to review it, however, a reference to the investigations of V. Siebold on the same subject may be of interest. The organs of hearing of Locustidae and Achetidae, says this author, are situated in the fore-legs, directly below the coxotibial articulation. With

a part of the Locustidae there is on each side of this point a fossa, while with another portion of this family there are, at this same place, two or more less spacious cavities (auditory capsules) provided with orifices opening forward. These fossæ and these cavities have each on their internal surface a long, oval tympanum. The principal trachean trunk of the leg passes between two tympanums, and dilates at this point into a vesicle whose upper extremity is in connection with a ganglion of the auditory nerve.

This last arises from the first thoracic ganglion and accompanies the principal nerve of the leg. From this ganglion in question passes off a band of nervous substance, which stretches along the slightly excavated anterior side of the trachean vesicle. Upon this band is situated a row of transparent vesicles containing the same kind of cuneiform, staff-like bodies mentioned as occurring with the Acrididæ. The two large trachean trunks of the fore-legs open by two wide infundibuliform orifices on the posterior border of the prothorax, so that here, as with the Acrididæ, a part of this trachean apparatus may be compared to a tuba Eustachii. With the Achetidæ there is on the external side of the tibia of the fore-legs an orifice closed by a white, silvery membrane (tympanum), behind which is an auditory organ like that just described.

Mayer, who quotes Siebold as above, does not agree that the existence of a tympanic membrane is the only test of the existence of an auditory apparatus. It is true, says Mayer, that such a test would apply to the non-aquatic vertebrates, but their homologies do not extend to the articulates; and besides, any physicist can, not only conceive of, but actually construct other receptors of aerial vibrations. This he proves conclusively by experiments to be reviewed in a following page of this report.

In Prof. Schmidt's article,* which constitutes a valuable

*The Auditory Organ of the Grasshopper. With three plates By Prof Oscar Schmidt, of Strasburg. Arceiv. f. Mikroskopische Anatomie, 11, Bd., 2, Heft.

contribution to the history of this difficult branch of research, the author compares the structure of the auditory organs of two families of grasshoppers, the Acridia and the Locustidæ. He finds that there is a total absence of homology between the two groups in respect to these organs, although their respective anatomies have been studied as if such existed, and as if the physiological action of audition depended in the two cases upon similar morphological and mechanical conditions. "Convergence" is a term applicable to the production of *apparent* homologies, even in series of wholly distinct descent. But even convergence, in the sense of similar morphological structure, seems to the author to be absent in the case here described.

The anatomy of these parts is extremely hard to examine, and therefore there exists as yet no completely satisfactory account of it.

Among the Acridia, three species were examined, viz. Parapleurus typus, Stenobothrus rufus, and Œdipoda cœrulans. In these, there is a membrana tympanica, stretched upon an annulus, the latter incomplete at its lower and hinder part, the interval being filled by ordinary chitin-tissue. The termini or legs of the imperfect ring receive attachments of muscles, intended to regulate the tension of the membrane. The "stigma," a body lying between these termini, has a hook at its extremity, which perhaps also serves for the attachment of muscles. The outer layer of the tympanic membrane is set with dots and papillæ in concentric order; the inner layer has some less marked concentric striations.

At the lower part of the membrane there exists a group of bodies or processes from the membrane, called, collectively, the "Hornvorsprünge," and answering to the labyrinth; they have been imperfectly described. These are, first, the cone called by Leydig, "Vereinigungshöcker," a curious funnel-shaped depression of the membrana tympani pointing inwards; second, a lateral process of the first, called "Seitenjoch"; and third, a shallow pit in the membrana tympani,

called the "Grube" (fossa), both formed by duplicatures of the membrane, and lying close to the cone; fourth, the capsule, or trilateral vesicle in the membrana tympani at its middle, projecting inwards, and connected with the cone by a fine tube.

The auditory nerve approaches this group from below, and close to the cone forms a large ganglion with many cells. There are rod-like terminations towards the cone and its two adjuncts; Leydig says that the ganglion is applied directly to these parts, while Hensen suspects the existence of an intermediate space containing "labyrinth-fluid." The latter view is decidedly opposed by Schmidt. A process of the ganglion is sent off to the capsule, through the tube mentioned; a small ganglion is interposed in the course of the tube. In the capsule itself there are distinctly seen isolated cells; the author is certain of the existence of rod-like terminations, also, and of some very fine thread-like processes which pass outwards into certain pores or cutaneous canals in the walls of the capsule (recognized by Leydig). This shows that the trilateral ganglion (in the capsule) is not to be considered a peripheral organ, but rather a point for the meeting of numerous peripheral elements. This view is still further confirmed by a thin membrane, found by Schmidt in two preparations, lying between the matrix of the tympanic membrane and the tracheal vesicle (not to be confounded with trilateral vesicle), and connected with the capsule; this membrane carries fine threads, which pass from the periphery of the tympanic membrane towards the capsule, taking up spindle-cells in their course, and finally enter the cutaneous canals in the walls of the capsule. These threads, with their attached cells, are doubtless the nervous conductors of impressions derived from vibrations at the periphery of the membrana tympani. We do not know how they terminate.

The tracheal vesicle is spread out in a flat shape under the ear, but is so slightly connected with the latter, and is so ill-adapted as a resonator — on account of the absence of spiral

elastic reinforcements — that Schmidt is led to regard it as having very little to do with the auditory apparatus.

Of the Locustidæ, there were examined L. viridissima, Xiphidium fuscum, and Phaneroptera falcata.

The ear is situated in the tibia below the knee, and has two tympanic membranes, one looking forwards, the other backwards, as the animal sits. Between these two is the tracheal vesicle, a modification of the great trachea which enters the tibia.

The apparatus called Hörleiste (auditory ridge or plica) contains a row of rods, like the hammers of a piano-forte, with their supports; this row is accompanied by the nerve to its extremity, as Hensen has shown. At the beginning, the nerve forms a ganglion. Leydig says the rods are arranged in two rows, but he probably encountered a specimen of a rare variety, for Schmidt found a double row only twice in a great number of preparations. The Hörleiste rests with its broad basis on the trachea; its free part is covered with a thin, chitin-membrane; it has an envelope divided into as many compartments as there are rods, thus isolating each rod completely from its two neighbors. Each rod is covered with a cell shaped like a pillow or four-sided cushion, which may be detached from the rod by chemical agents, and has two lateral cells lying closely fitted to it. The rod itself is composed of a firm envelope, a nerve fibre (the chorda of Hensen), and a head, which is a small body in the roof of the rod, into which the chorda runs. The chorda also lies in a special delicate tube, suspected by Hensen and demonstrated by Schmidt. Hensen's "basal-cell," described as lying at the base of the rod, is believed by Schmidt to be a part of the nervous route, — a basal ganglionic cell; the chorda passes down into and through it and on to the "lateral ganglion-cell," which is connected with the nerve-trunk.

In his final comments, Schmidt concludes that the two sets of organs are comparable only in their most general points. The presence of tracheal, ganglionic cells, tympanic disks covered with chitin, seems a matter of course: such things

as ganglia and nerve-fibres are common to all articulata, and as they are similarly affected by sound waves, one might expect that they would or might exhibit in different cases a similarity, resulting from adaptation or convergence. But not even this similarity results in the two families of grasshoppers, as the auditory rods are totally different. Hensen's comparison of these rods with the hearing-hairs of crabs seems to Schmidt wholly forced. It is very doubtful if crabs hear; it is not probable that their hearing-hairs have any relation to sexual commerce, whereas the grasshoppers have special apparatus for producing a noise, which is important in relation to this act.

Prof. Mayer substantiates his opinion with regard to the statement of Siebold already mentioned, by experiments upon the vibration of the fibrils of the antennæ of the mosquito, and opens a wide field for investigation into the organ of hearing of articulates. The beautiful structure of the plumose antennæ of the culex mosquito, says the author, is well known to all microscopists; and these organs at once recurred to me as suitable objects on which to begin my experiments. The antennæ of these insects are twelve-jointed, and from each joint radiates a whorl of fibrils, and the latter gradually decrease in their lengths as we proceed from those of the second joint from the base of the antennæ to those of the second joint from the tip. These fibrils are highly elastic and so slender that their lengths are over three hundred times their diameters. They taper slightly, so that their diameter at the base is to the diameter near the tip as three to two.

A live male mosquito was cemented to a glass slide and a $\frac{1}{5}$ objective brought to bear on various fibrils. Various tuning forks were then sounded with the openings of the resonant boxes opposite the stage of the microsope and turned towards the fibrils. On the first trial with a fork of 512 v. s. certain fibrils entered into vigorous vibration. The excursions of the ends of the fibrils were measured by a micrometer scale, and a table is given of the results. Certain

fibrils responded to particular notes; and from experiments on about a dozen mosquitoes it was inferred that their fibrils are tuned to sounds extending through the middle and next higher octave of the piano. The consideration of the relations which these slender, tapering, and pointed fibrils must have to the aërial impulses acting on them led to discoveries in the physiology of audition which are probably entirely new.

If a sonorous wave falls upon one of these fibrils so that its wave-length is at right angles to the length of the fibril, the latter cannot be set in vibration; if the vibrations in the wave are brought more and more athwart the fibril, it will vibrate with increasing amplitude, reaching its maximum of co-vibration when the wave-length is parallel to the length of the fibril. This was proved by varying the direction of the sound-producing body in its relation to the fibrils and measuring the extent of the resulting excursion.

These observations also revealed a new function of the antennæ, namely, the determination of the direction of sound. A live mosquito being placed under the microscope, attention was directed to one fibril, which vibrated to the sound of a tuning-fork; the stage of the microscope was turned until the fibril ceased to vibrate and a line drawn in the direction of the fibril cut within 5° of the position of the sound source. The antennæ of the male mosquito have a range of motion in a horizontal direction, so that the angle included between them can vary considerably inside and outside of 40°. The song of the female vibrates the fibrillæ of one of the antennæ more forcibly than the other. The insect spreads the angle between his antennæ and thus brings the fibrillæ situate within the angle formed by the antennæ in a direction approximately parallel to the axis of his body. The mosquito now turns his body in the direction of that antenna whose fibrils are most affected, and thus gives greater intensity to the vibration of the fibrils of the other antenna. When he has thus brought the vibrations of the antennæ to equality of intensity he has placed his body in the direction

of the radiation of sound, and directs his flight accordingly.

Some observers may assume from the fact of the co-vibration of these fibrils to sounds of different pitch that the mosquito has the power of decomposing the sensation of a composite sound into its simple components, as is done by the higher vertebrates. Mayer does not hold this view, but believes that the range of co-vibration is to enable it to apprehend the ranging pitch of the sounds of the female; in other words, the want of a definite pitch of the voice of the female demands a greater range of co-vibration. The author is certainly justified in the opinion that he has established a physical connection existing between the sounds emitted by the female and the co-vibrations of the fibrils of the antennæ of the male, but only the establishment of a physiological relation between these parts and its nervous system will permit the assertion that the antennæ are really the auditory organs of the insect.*

In the same series of papers, including many valuable suggestions and contributions to the experimental study of acoustics, Prof. Mayer gives an experiment by which he analyzes a composite sound. A loose, inelastic membrane was placed over an opening in front of the wooden chamber of a Greniès free reed-pipe. To the centre of this membrane were attached the ends of several fine silk fibres, the other ends being attached to the branches of tuning-forks mounted on their resonant boxes, eight forks being so connected. The fundamental tone of the pipe was Ut_2, 128 v. s., and the pipe was brought into accurate unison with a fork giving this sound. The forks connected with the membrane were the harmonic series of Ut_2, Ut_3, Sol_3 Ut_4, Mi_4, Sol_4, $B\overline{\flat}_4$, and Ut_5. The fibres being but slightly stretched, on sounding the pipe all the fibres break into exquisite combinations of ventral segments, gradually tightening the fibres the number of nodes diminishes, and at a certain degree of tension with fibres 1 metre long, they all vibrate with single ventral seg-

*See *Landois* Ton und Stimmapparate der Insecten. Siebold's Zeitschrift fur en Wissenschaftlich Zoölogie. 1867.

ments. Gradually increasing the tension, the amplitudes of these single segments gradually diminish and finally disappear.

The point of the membrane to which the fibres are attached is actuated by a motion which is the resultant of all of the elementary pendulum vibrations existing in the composite sonorous wave, and the composite vibrations of this point are sent through each of the fibres to its respective fork. Thus each fibre transmits to its fork the same composite vibratory motion, while each fork can only vibrate so as to give the simple pendulum vibration of a simple sound; for each fibre is attached to its fork at a point which lies in the upper node of the segments into which the fork divides when it gives its higher harmonic. When the pipe is in tune with the harmonic series of forks, the latter sing out when the membrane is vibrated; but if the forks be even slightly thrown out of tune with the membrane, either by loading them or by altering the length of the reed, they remain silent when the sounding pipe agitates the membrane and the connecting fibres. By this interesting experiment is obtained both the analysis and synthesis of a composite sound; for on sounding the reed it sets in vibration all the forks of the harmonic series of its fundamental tone, and after the reed has ceased to sound the forks continue to vibrate, and their elementary simple sounds blend into a note which approximately reproduces the *timbre* of the reed-pipe. This experiment further illustrates the hypothesis of audition framed by Helmholz to account for the fact that the ear can decompose a composite sound into its sonorous elements.

The paper of Küpper on the function of the external ear and the view taken by Darwin (that the irregularities in the contour of the auricle are the remnants of the large auricle of the lower animals, having, in all probability, none other than a purely mechanical office, namely, the stiffening of the auricle) have called forth an expression of opinion on this subject from Urlach, who holds that a regular breaking or reflection of the sound is only to be considered possible

when the wave-length of the sound coincides with the linear dimensions of the reflecting surface. The structure of the auricle is such that it is inadequate to fulfil the function of collecting and reflecting the sound; it cannot, therefore, serve to assist in determining the direction of the sound source. At very short distances the greater intensity of the tone on one side or the other may allow of the determination of direction; but at greater distances and with deep tones (and consequently longer sound-waves), the head throws no sound-shadow, and the difference in intensity on one side or the other is not noticeable. The author, therefore, takes the ground that the external ear serves as a resonator for higher tones, — as, for instance, in animals, — for such tones as would be important to their habit of life, as rustling of grasses and leaves, and the like.

Although this report is intended simply as a report on the progress of Otology, and not, as Prof. Jacoby has, in his reviews in the Archiv für Ohrenheilkunde, taken the liberty of considering that it should be, a critical review, it would hardly be just to the subject under consideration to pass over the views of Prof. Mach without suggesting a comparison with the recent communications of C. H. Burnett on the same subject.

Incited by the interesting and successful experiments of Prof. Coccius on the examination of the eye in polarized light, Drs. Hagen and Stimmel have applied the same method of examination to the ear. The apparatus employed for the purpose consisted of a plain mirror of 13‴ diameter, and having a central opening of 3‴ diameter, placed between two Nichol prisms, each of which, surrounded by cork, was contained in a brass case. The mirror was surrounded by a metal ring, having joints at two opposite points, one of which united the mirror with the metal case of the large Nichol prism, and allowed the mirror to be placed at various angles to the larger prism. The opposite joint united the mirror to the smaller metal case of the second prism, which was placed behind it.

The case was set obliquely from left to right, in such a position that the smaller prism, with each change in position of the mirror, could be placed vertically to the central opening of the latter. The smaller prism, furthermore, was movable in its metal case, so that, during examination, its plane of polarization could be placed at right angles to the plane of polarization of the larger prism.

The authors, also, found it of advantage to add a ball and socket joint at the lower portion of the ring holding the mirror, for attachment of a twelve-inch convex lens. By placing this lens over the face of the mirror, the latter was converted into a concave mirror of six inches focus; by placing the lens behind the mirror it served to enlarge the picture; while in order to examine with the mirror alone; it was only necessary to turn the lens downward.

The strong illumination necessary for this method of examination was furnished by a Tobold lamp. The lamp was placed at the left of the observer, at the height of the ear under examination, and in such a position that the column of light passed close to the ear at right angles to the long axis of meatus.

An ordinary speculum was placed in the ear and held by an assistant; with the left hand the larger prism was placed at a distance about half an inch from the opening of the Tobold lamp, while the right hand seized the smaller prism placed behind the mirror, and set the latter at an angle of about 45° to the larger prism. The instrument was held nearly horizontal, so that the light from the lamp, passing through the larger prism or polarizer, fell upon the mirror and was reflected into the ear.

On examination under these circumstances, the ear presented the usual appearance; but on placing the smaller prism or analyzer behind the mirror, and bringing the plane in position by turning the metal case, the effect of polarization was produced, the light returning from the membrana tympani through the opening in the mirror, passing through the analyzer before reaching the eye. Under these circumstances,

the following changes in the appearance of the membrana tympani are observed: The delicate lustre which overspreads the normal membrana tympani is wanting; the light reflex disappears. The location of the light reflex, however, is of a bluish-white color, and somewhat lighter than adjacent parts. The explanation of this is probably that the light rays, returning from this portion of the membrana tympani, are largely absorbed by the polarizing mirror. Other light spots from the surface of the membrana tympani, and the reflections from the fluids in the meatus, also disappear. Transparent portions of the membrana tympani may be made apparently to disappear entirely.

A very common occurrence was the entire disappearance of the posterior-superior segment, rendering the long process of the incus and portions of the stapes and promontorium visible. Other portions of the membrana tympani presented the appearance of a delicate veil. It was also possible to determine the presence of adhesions and pseudo-ligaments in the tympanic cavity. All opacities of the membrana tympani, such as calcareous deposits, ecchymoses, and the like, appear more distinctly defined, and the blood-vessels of the manubrial plexus were more clearly visible.

Enough has been done, as shown by the above short review of the results arrived at by the observers, to demonstrate the advisability of further experiments upon the use of polarized light in examination of the ear; and the suggestions thrown out in their paper as to examination of the movements of the ossicula and of morbid appearances, such as serous or purulent accumulations within the middle ear, and the various forms of opacity of the membrana tympani, point to a larger application of this means of illumination than that of a simple experimental test.

An interesting note is made by Mendel in Virchow's Archiv on the temperature of the external auditory canal. This he finds, in the healthy individual, as the result of several experiments, to be on the average two tenths of a degree lower than the temperature of the rectum. During the

apoplectiform and epileptiform attacks of paralytics, the temperature of the auditory canal was increased in proportion to the increase of temperature in the rectum. On the other hand, the temperature was found to decrease decidedly during sleep produced by chloral, or after the subcutaneous injection of morphia.

Boettcher has written a second paper on the division of the semicircular canals, which is of a character to demand thoughtful consideration and comparison. It is in the form of a criticism on the hypothesis of Goltz, that the semicircular canals form a system which serves to assist in the preservation of equilibrium.

Boettcher first attempts to show that the anatomical relationships of the parts have not been sufficiently considered by Goltz and others, and that, therefore, the results of the experiments (those made upon pigeons) are open to question: as, for instance, the inner vertical canal lies so close to the brain that its division without injury to the latter is impossible; the canal, moreover, is accompanied by a large vein, injury to which and the consequent hemorrhage is with difficulty avoided. The rolling movements observed by Goltz are considered by Boettcher to have nothing to do with the division of the semicircular canal, but to result from a lesion of the brain. The lower portion of the inner vertical canal may be divided without injury to the brain, but hardly without dividing the large vein, the bleeding from which would be a serious obstacle to accurate determination of results.

As concerns the outer vertical canal, Boettcher accuses Flourens, Czermak, Brown-Séquard, Goltz, and others, of leaving out of consideration and of injuring another portion of the brain, to which Schklarewsky has drawn attention in birds, as a cavity bounded by the semicircular canals and in communication with the cranial cavity (cavitas mesootica), and which is not, as has been supposed, a process of the brain, but the aquæductus vestibuli, and which it is very difficult to avoid in operating on the semicircular canals.

The inferior arm of the external vertical canal and the

posterior arm of the horizontal canal are, on account of their size and depth, less available for operation, but have, however, this advantage : that at one point, from 1.5 to 2 mm. in length, the canals are unaccompanied by a blood-vessel, and that at this point injury to the aqueductus vestibuli may be avoided. Boettcher gives, in this paper, his method of operation; and the results of his experiments, which may be divided into three groups, were, firstly, results similar to those of Goltz; secondly, cases in which the operation was not perfect and resulted in various derangements of motion on both sides; thirdly, cases where division of the semicircular canals of both sides was followed by slight derangements of motion which shortly subsided.

The conclusions to be drawn from these experiments Boettcher arranges under the following heads : —

1. The lateral rotation of the head and its sinking to the ground, so that the head rests upon the ground and the beak seems to be directed more or less backward. This symptom may be produced by careless division of the canals on one side, but this symptom does not appear when the division of one or more canals on one or both sides is carefully made.

Boettcher concludes, therefore, that the movement of the head is not directly the result of the division of the canals, but much more probably of changes in the brain consequent on the operation. An examination in the cases mentioned showed extravasation in the cerebellum or medulla oblongata, or else the commencement of an inflammatory process.

It is worthy of notice, moreover, that the rotatory movements of the head are often suddenly developed, some time after the operation. In such cases there was found extravasation in the meninges of the brain with inflammatory processes. A purely inflammatory process was found to have been accompanied by gradually increasing movements which finally became constant.

2. In regard to the general rotatory movements and the movements forward and backward, no anatomical changes were to be found in the cranial cavity. The movements,

however, are not due to the division of any two semicircular canals, that is, as the result of the elimination of their function.

Division of the semicircular canals may, it is true, be the cause of the movements, but the resultant movements themselves show that they are not caused by a division of the semicircular canals alone. In support of this view Boettcher advances the following arguments: —

(*a.*) That after division of the semicircular canals on both sides the movements which occur at the time may entirely disappear, the animals experimented upon appearing in perfectly natural condition, and a subsequent examination showing that the canals had been wholly divided. If the destruction of the semicircular canals, and the vertigo resulting therefrom, were the cause of the symptoms described, it is natural to expect that the movements would have continued.

(*b.*) The fact that the derangements of motion always made themselves apparent in the extremities of the side on which the semicircular canals were divided. If the injury is slight, the movement is a momentary contraction of the foot. As in division of a horizontal canal the extremity moves inward, so in division of an external canal the foot moves forward. Movements of the wings are observed with greater difficulty; they have less strength and move more irregularly.

(*c.*) The movements under consideration are observed both in walking and flying, sometimes only in either one or the other. This fact the author presents as an argument against the theory of vertigo, and presents cases where the derangements of motion were shown in either the act of flying or that of walking, alone. Vertigo would have affected both acts equally; the lesion, therefore, must have been a local one, which affected only either the wings or legs.

(*d.*) The character of the derangement of motion is moreover dependent upon the situation of the point at which the section is made. Section of the horizontal canal induces *mouvements de manége* of the corresponding side; similar

movements result from division of the exterior vertical canals above the crossing point, in both cases wings and legs being apparently affected. If these canals are divided below the crossing point, there is a tendency to fall backward without loss of power over the wings; a tendency to fall forward results from division of the inner vertical canal. Vomiting occurs on division of the posterior arm of the horizontal canal, or the inferior arm of the outer vertical canal, or when both are divided.

Concerning the pendulum movements of the head, Boettcher's experiments show that they are a passing symptom, occurring with considerable intensity immediately after the operation; they gradually diminished and often entirely disappeared.

In some cases they did not appear after bilateral division of the semicircular canals. As a rule, if rotation of the head occurred the pendulum movements ceased.

Rotation of the head and rolling movements occurred immediately after operation as the result of lesion of the brain, or were developed as the result of pathological processes which implicated the central nervous system. The *mouvements de manège*, the tendency to fall forward or backward, and the pendulum movements in a horizontal or vertical direction, are certainly connected with the injury to the semicircular canals, as Flourens has stated. The former Boettcher considers as due to changes in the crura cerebelli resulting from division of the canals. The pendulum movements are more difficult of explanation; his experiments, the author considers, show them to depend upon a sympathetic affection of the central organ; and the fact that pendulum movements, as a rule, are followed and supplanted in a few days by rotatory movements of the head would allow the inference of there being a common cause for both.

Berthold also, treating at length of the same subject, is by no means satisfied with the existing explanations of the symptoms following division of the semicircular canals, and bases his experiments on the recognition of the fact that to

arrive at any conclusive results the division of the canals must be effected without implication of the central organ. After confirming the statement of Schklarewsky, above mentioned, he describes his method of operation, which consists in the use of silk thread for section of the canal. This method has the advantage of avoiding the bleeding mentioned by Boettcher and experienced by all who have made similar experiments, and of permitting the production of symptoms consequent on division of the canal uncomplicated by other symptoms, the result of pain and fear during the operation.

In the description of the results of his experiments, Berthold contradicts the usually received opinion that injury of the osseous canal alone has no effect in production of these derangements of motion.

Manège movements following division of the canals were not observed by Berthold, but vomiting was observed, and in cases, moreover, where any injury to the brain was out of the question ; and he quotes as analogous the observed fact that dogs vomit easily after a slight operative injury. The author furthermore confirms the statement of Flourens and Löwenberg, — that pigeons execute the same movements on division of the semicircular canals, after opening of the cranial cavity and separation of the cerebellum from the cerebrum, as when the central organ is left intact, — but does not agree with Löwenberg that chemical irritation of the membranous canal after operation increases the intensity of the movements.

Berthold also gives in this paper the results of his experiments on injury of the processus cerebelli mesootici alone, a portion of which resemble the results of injury of the semicircular canals.

The first symptom is a sudden dropping of the head and neck towards the side opposite to that operated upon, or else the bird draws the head upon the neck, touches it to the ground, and hops upon the leg of the injured side. Following extensive injury the birds made excessive move-

ments, turned a somersault, and rolled themselves upon the long axis of the body until exhausted; when rested they repeated the same movements. When the birds survived the operation they carried the head inclined towards the injured side, and in walking extended the leg of this side less than the other, from which *manège* movements towards the affected side resulted. In other cases, twisting of the neck and unsteadiness of gait resulted, as is characteristic after removal of portions of the semicircular canals.

In conclusion the author gives his explanation of the twisting of the head to one side. In animals with the semicircular canals intact each movement of the head results in an irritation of the nerves in the ampullæ which is transmitted to the centre of co-ordination and results in a reflex movement, which always corresponds with the movement communicated in the uninjured canals. If, however, the canals are injured the nerves in the ampullæ are affected by an irritation of heterogeneous character and lead to reflex movements of a corresponding character; vertigo results, and is evidenced in pigeons by a turning of the head with the vertex downward. Animals in which the brain is destroyed make pendulum movements after injury to the semicircular canals, but do not turn the head; they cannot suffer from vertigo since consciousness is wanting.

According to Berthold, therefore, the semicircular canals have this function, — the assistance of co-ordination of motion by means of reflex action.

The principal result of a series of experiments conducted by Bornhardt lay in the determination of the question as to whether the consequences of division of the semicircular canals were to be considered as symptomatic of irritation or paralysis of the nervus vestibuli. An important step towards determination of this question is found in the following propositions: —

1. That the movements following the division of the semicircular canals, in the majority of the cases, are the result of injuries accompanying the operation, which are difficult of

avoidance, and the symptoms are not explainable by any of the theories as yet advanced.

2. Experimental investigation of the Breuer-Mach theory determines the latter to be untenable. If rabbits or pigeons, for example, in which the canals have been carefully divided, are fastened upon a centrifugal table, and rotated in a horizontal plane, the compensatory movements of the head are observed precisely as they occur in animals not operated upon. The symptom recurs with each repetition of the rotation, and on coming to rest the head resumes its original position.

3. Movements of the head and eyes occur in animals operated upon, but much less forcibly than in uninjured animals.

4. Certain anatomical data also controvert Mach's theory, and indicate that the contents of the canals are adapted rather to the transmission of vibrations than to that of progressive movements.

5. These vibrations must be induced by muscular contraction during the change in position of the head. The author is, therefore, of the opinion that the semicircular canals serve, by transmission of the vibrations resulting from muscular contraction, to intensify the muscular sensation during action of the muscles of the head.

6. The following experiments the author considers as confirmatory of this conclusion: The horizontal semicircular canal of a rabbit being exposed without injuring its osseous covering, and the back of a knife being rubbed backward and forward upon it, by which means it is merely agitated, the same movements of the head and eyes occur which are characteristic of division of the membranous canal.

7. The direction of the muscles attached to the head is parallel to the direction of the semicircular canals, which fact seems to favor the above conclusion.

8. Movements similar to those resulting from division of the canals have been induced by an experiment which leaves both the brain and the osseous semicircular canals intact

The vertical and horizontal canals in pigeons were exposed to a continuous stream of æther by means of an atomizer; they were also touched by a red-hot needle. In both cases the same symptoms appeared as in division of the canals; the same result was also obtained by touching the canals with a vibrating tuning-fork. The ingenuity of the theory advanced by the author, and the method of experiment which leaves the organ in question intact and therefore in condition for the normal fulfilment of its function, awakens a greater interest in the further and more complete communication which he promises soon to publish.

Prof. Julius Budge suggests as an explanation of the vertigo, and also of the disturbance of equilibrium on section of the semicircular canals, the action of the musculus stapedius, which, by a curious mistake, the author has described as attached to the anterior side of the head of the stapes. The suggestion may be briefly stated as the effect of continued and of intermittent intra-labyrinthine pressure, due to contraction of the musculus stapedius and consequent excursion of the base of the stapes, the action of the musculus stapedius being the result of reflex movements in the region of the nervus facialis from which the muscle is supplied. To counteract the effects of resulting vertigo, continued movements are made to restore equilibrium. If, now, the semicircular canals are destroyed no vertigo results from the contraction of the musculus stapedius, and co ordinate movements to maintain equilibrium are wanting.

In a brochure entitled "Séméiologie du Vertige dans les Affections de l'Oreille," Bonnafont gives a *resumé* of the experiments of Flourens and Brown-Séquard on the semicircular canals and of the clinical observations of Menière, Knapp, and others. His conclusions are, — 1. Vertigo in aural affections is not due exclusively to inflammation or primitive congestion of the membranous semicircular canals; in other words, it does not constitute a pathognomonic symptom of the affection known as Mènièr's disease. 2. Vertigo may be the result either of traumatic lesions of the semicir-

cular canals, as the experiments of Flourens have demonstrated, or of a consecutive inflammation, or congestion of the membranous portions of those canals. 3. Inflammation and hyperæmia of the semicircular canals appear to act by increasing the pressure of the intra-labyrinthine fluid. 4. Every affection of the middle ear which increases or diminishes the intra labyrinthine pressure may produce vertigo. 5. The vertigo may be the result of reflex action, as is the case after the injection of cold water upon the membrana tympani.

The observations of Prof. Moos on the abnormal perception of certain sibilant sounds (*s* and similar consonants) and of high musical tones were made upon patients suffering from a primary affection of the ear, and upon others in whom the nervous portion of the organ of hearing, originally healthy, had become secondarily affected. The latter cases included principally persons of musical culture between the ages of sixteen and fifty-three. Case 1 is an example of the first class: the patient heard deeper tones plainly, and also the first five tones of the third octave, the tones from d″ to g″ slightly, and above the latter not at all; the voice in a loud tone was heard at eight paces. In the second group of cases subjective noises were present, but neither the outer ear nor membrana tympani presented any abnormal appearance, with exception of diminished mobility of the latter, and in the majority of the cases, hyperæmia of the manubrial plexus, the Eustachian tube free, but the sensation in the middle ear on catheterization either increased or diminished. Hearing, as tested by the watch, gave as the maximum (30′ normal hearing distance) 15,″ as the minimum 0; tested by a loud voice ten paces the maximum, one half pace the minimum.

Wreden proposes substituting the examination of the ear for the examination of the lungs in certain cases where it is necessary to determine whether a child has been still-born, and his paper is a contribution of value to medical jurisprudence. The author first gives the substance of his former

paper,* in which he describes the recession of the mucous membrane filling the middle ear in the fœtus, and its relation to respiration, as has lately been described also by Wendt, and is evidence of the entrance of air into the middle ear.

As the result of actual observation it has been determined that the mucous, membranous mass disappears totally in twenty-four hours,—in twelve hours but partially,—and that recession follows a regular order, namely, first, it disappears from the Eustachian tube, the floor of the tympanic cavity and membrana tympani; then from the posterior portion of the tympanic cavity and labyrinth wall; and lastly from the roof. The paper concludes with a careful description of the method to be followed in making the necessary post-mortem examination of the ear.

II.

PATHOLOGY AND THERAPEUTICS.

Wreden reports that he has observed twelve cases of a peculiar form of obstruction of the external meatus characterized by excessive toughness and pertinacity of hold, requiring much time and effort for its removal, and the use of strong alkaline solutions. Externally it resembles a "piece of Chinese tea-paper folded several times upon itself." It is lamellar in structure, is composed of dry cells of epidermis, "and is therefore the product of an excessive exfoliation of the epidermis of the skin of the meatus produced by a pathological irritation." No fungous growth was present save in one case, in which he found a "beautiful and enigmatical vegetable structure," the botanical nature and signification of which are as yet unknown to him. It shows a long, double-outlined tube, having at regular intervals vesicular swellings covered with hairs.

Dr. Kipp reports a case of pearly tumor in the external

* Otitis Media Neonatorum, Berlin, 1868.

meatus. These cases, according to Lucæ and others, are not rare in Germany, but they have been scarcely observed in this country. The patient, a man of twenty-seven years, had scarlatina when six years old, followed by discharge from both ears, which continued till he was twelve, since when his ears had been quite dry. During his sixteenth year he noticed a gradual increase of deafness, which was relieved by removal of large white masses from both ears. For a year previous to being seen by Dr. Kipp he had suffered from persistent severe pain in the back of the head, vertigo, and sickness of stomach, — symptoms believed by his family physician to be due to malarial fever and treated accordingly, but without the slightest relief. There had also been at times pain in the ears. The external meatus on both sides was found to be filled by masses supposed at first to be cerumen, but after syringing presenting a whitish, pearly surface. These were removed piecemeal by patient digging and picking, without causing much pain. There was great improvement of hearing. On the left side the osseous part of the external meatus was greatly increased in calibre; the walls were carious, and in some parts covered with granulations; the membrana tympani and ossicles were wanting. The right external meatus was in the same condition, but the membrana tympani was present, opaque and thickened. The tumor was lamellated in structure, and was found to be made up of flattened epithelial cells, crystals of cholestrine, fatty acids, and minute shining bodies, some round, others irregular. The patient appeared again after three months deaf as before, with a profuse discharge from the left ear, each meatus lined by a thick, white, shining membrane, having the same microscopic characters as the masses previously removed. For six months following the patient was seen at short intervals, the external meatus every time containing more or less of the same white material. The granulations were treated by applications of nitrate of silver and instillations of weak solutions of sulphate of copper, and gradually disappeared, since when no more of the white substance has

formed, no carious bone is present. All the conditions indicated that the tumors had their origin in the external meatus.

In a long article Wreden sums up the results of his own and others' observations on the subject of fungous growths in the ear, to the knowledge of which he has already contributed so much. He has seen seventy-four cases, all of which were the usual forms of aspergillus flavescens or aspergillus nigricans, with a solitary exception, which he describes.

A blood-red mass was found in the meatus of a patient who had been for two days suffering severe pain in the ear, with tinnitus and hardness of hearing. On removal of this mass the membrana tympani was seen to be uniformly red and swollen. The ear regained its normal condition after application for six days of an alcoholic solution of tannin, and there was no return of the malady. Microscopic examination revealed the presence of a fungus richly supplied with capsular sporangia or asci, which on account of its intense red color he has named for the present otomyces purpureus. After consultation with a distinguished mycologist, M. Woronin, he concludes that this fungus is the ascomycete or perithecal fruit of the aspergillus nigricans. According to his statement the aspergillus has two forms of fructification, viz. a utricular fruit representing the perfectly developed form of the fungus, and a conidianiferous form (globular sporangia studded with sterigmata which throw off the spores) representing the incomplete development. The first form in its maturity assumes a yellow or yellowish-red color. The second or incomplete form only had hitherto been observed in the ear of man or beast, and this case of his he regards as a unique exception.

Dr. J. Orne Green, also, in a report of the proceedings of the Boston Society of Medical Sciences, published in the "New York Medical Journal," speaks of meeting with this red aspergillus. "The third specimen was unusual, in that it showed many of the characteristics of aspergillus, except in its color, which was a bright red. It was taken from a patient suffering from slight chronic eczema of the meatus,

whose ear, when seen at one visit, was entirely free from the growth, but when examined four days after was partially filled with a large number of bright-red flakes. . . . An examination of the masses showed a mycelial growth of large size, with a stalk here and there which ended in a small round head resembling a young sporangium of the aspergillus. In the examination which had been made, however, none of these heads could be found with the spores attached. Great numbers of very large free spores, of a pale reddish color, were seen in thick clusters, and the collection of these gave the peculiar color to the mass."

Wreden's conclusions are : —

1. That, with the possible exception of three or four cases in the more than one hundred reported, the aspergillus nigricans and the aspergillus flavescens are the only forms of fungi hitherto found in the ear, the former being much the more frequent; and he discredits the observations of Steudener, Hassenstein, and Hagen, according to which penicillium, graphium, and other fungi are found in the external meatus.

2. That the false membrane is developed only on the membrana tympani and immediately adjacent parts of the meatus, rarely involving so much as the inner third of the same, and unattended by *purulent* discharge. "An existing purulent inflammation of the ear, as a rule, excludes the possibility of fungous growths, but an ear in which such an inflammation has run its course may evince a certain predisposition towards the formation of fungous growths."

3. That the "surface of the false membrane turned towards the cavity of the auditory meatus usually looks white, like a piece of fat pork, while the surface turned towards the membrana tympani contains the ripe sporangia in the form of bright yellow (A. flavescens) or black (A. nigricans) spots, arranged very often in circles. In one solitary case, in which I found the highest development of the fungus, viz. the ascomycete form, the entire false membrane possessed, in all its layers, a beautiful purplish-red color."

4. "I have never found that fungi could be a long time in the auditory meatus without producing morbid changes. Though in a few cases, there was no pain or itching, hardness of hearing and objective symptons of irritation were always present."

5. While he has often observed in the course of myringomycosis, an otitis externa circumscripta, as well as diffusa, he has never seen a parasitic inflammation of the external meatus without a simultaneous or an immediately preceding myeosis of the membrana tympani, though he does not deny the possibility of such an occurrence.

6. He considers myringomycosis an independent parasitic disease, the fungus being not a mere saprophyte living on dead organic matter, but capable of attaching itself to living tissues, and, as in a case of Politzer's, invading the fibrous layer of the membrana tympani, and even causing perforation.

In connection with the foregoing paper of Wreden's, Dr. C. H. Burnett reports a case of myringomycosis illustrative of the typical features of the disease. It occurred in a female forty years of age under treatment for chronic catarrh of the middle ear, who, for more than a year, had been subject to sudden attacks of acute pain in the left ear, lasting for a day or two, with augmented hardness of hearing, and then suddenly ceasing with slight watery discharge. On examination of the ear during one of these attacks, the membrana tympani and inner part of the meatus were found covered with a membrane resembling wet paper, which was easily removed without pain by the forceps. A drop of serous discharge from the meatus was found, on microscopic examination, to contain spores of aspergillus flavescens. The false membrane was formed chiefly of thalli, and upon its surface were free spores and aërial fructification of the aspergillus. The patient had been living for some time in a damp house, the cellar of which was covered with mold. Previous to living in this house she had never suffered from fungous disease of the ear. The treatment consisted in the application of a so-

lution of nitrate of silver (100 gr. Aq. fl. ℥i.) several times repeated, the instillation of alcohol (90 per cent) six times daily, and frequent syringing with warm water.

Dr. Cassells, of Glasgow, read before the Medico-Chirurgical Society, Nov. 6, 1874, a paper on Myringomycosis Aspergillina or Otitis Parasitica, in which it appears, according to his statement, that this form of ear-disease had been regarded by English surgeons as a foreign disease. As late as 1874, Hinton, of London, had not seen a case in England, nor did he know of any aural surgeon who had. This seems to have been from want of careful examination, for Cassells in one week after he began to look closely for aural fungus, found three cases of aspergillus flavescens, shortly after a case of aspergillus nigricans, and more recently several other cases of the former.

Pflüger describes a case of congenital fistula auris occurring in a child of six years. On both sides there was an opening as large as a pin-head, seven millimetres anterior to the helix, on a level with the lower branch of the antihelix. Into this a sound could easily be passed for 1½ cm. These openings had been noticed at birth, and Pflüger believes that they communicated with the middle ear, as, according to the mother's statement, whenever the child had earache pus had been discharged through them. The patient was seen but once, and a perfectly satisfactory examination was not obtained.

In another article Pflüger describes two cases of rupture of the membrana tympani. One of these occurred in a man twenty-six years of age, who, while bathing, was struck by a wave on the right ear, which caused a sharp pain. This disappeared after a few hours, but his hearing was left impaired. Inspection on the following day revealed a roundish opening in the posterior portion of the membrana tympani, with coagulated blood on its edges. This perforation still remains, months after its formation, without a trace of suppuration. This patient was a cultivated musician, and Pflüger took the opportunity of testing with him the state-

ment made by Rumbold of St. Louis, in the New York Medical Record, of April, 1874, that where there was perforation of the membrana tympani there was no increase in the sound of the tuning-fork on stopping the meatus, as is the case with normal ears, and that this was so constant as to be pathognomonic. Repeated trials with this educated ear showed that the strengthening of the sound of the tuning-fork *did* take place and unmistakably, though perhaps to a less degree than on the unaffected side.

In the second case the rupture was caused by an explosion, and was in the posterior lower quadrant, oval in shape, and with some blood coagula on its edges. There was no foreign body in the ear, and the rupture was evidently caused by the expansion of gases. It healed after a few days.

Dr. Joseph Simrock, of New York, reports that in a number of cases of chronic otitis media catarrhalis, with little or no opacity of the membrana tympani, where the Eustachian tube was pervious and the ordinary methods of treatment have been tried without avail, he resorted to a new method of opening the tympanic cavity. This method consists in the application of sulphuric acid upon a selected spot, usually in the posterior part of the membrana tympani. "The way of applying it is to bring the end of a fine probe which has been covered with a thin layer of cotton and afterward dipped in strong sulphuric acid in contact with the surface of the membrane, either to a particular spot, with slight pressure, or by rubbing it over a larger field. In the first case an opening may be produced almost instantaneously; in the latter the fluid dries in, and after a while the parts over which it has been spread, having become anæsthetic, may be removed by a probe like so much paper tissue."

The writer states that very little pain or irritation followed the operation, and that of seventeen cases operated on in this way three remained open four months. His plan is to reopen the aperture after its closure, by the same means, with the hope that the regenerative power of the membrane will in the end be lost, and the opening become permanent.

He states that in a considerable proportion of his cases there was improvement of hearing and diminution of tinnitus.

Weber-Liel, in an article in the Monatschrift für Ohrenheilkunde for April, 1875, says of this method of Simrock's that he has tried it in six cases, and finds it simple, free from danger, and but slightly painful. In these six cases the inflammatory reaction was very moderate, and the hearing was improved in five.

Drs. Pomeroy and Roosa, who have tried this method of Simrock, report very different results, the pain and inflammation produced being so severe as to preclude a repetition.

Dr. H N. Spencer, of St. Louis, also informs the reporter that he has tried Simrock's method in six cases, with the result of setting up such severe inflammatory reaction and obtaining so little improvement of hearing as to discourage him from resorting to it again.

Weber-Liel, in the article mentioned, referring to the results of a procedure formerly proposed by him, which was by repeated perforations of the drum membrane at the same point to overcome its reparative power so that a permanent opening would finally be left, says that in one case an opening made in 1868 still continues, and that in another an opening has remained four years, and that the hearing has risen from eight inches to six feet for a watch heard normally at fifty feet. In this case galvano-cautery was first used, and afterward a piece cut out of the cicatricial tissue left as the result of the first operation. A good deal of inflammatory action followed both these steps. In a third case, operated on first with the ring-formed galvano-cauterizer, October 7, 1871, and the cicatrix from this touched with caustic potash, November 3, 1871, there was considerable inflammatory reaction, but the hearing rose from contact to three inches for a watch heard normally at fifty feet. The air-douche and other means of treatment were employed after the operations in these cases. He speaks favorably of Voltolini's new method of perforating the drum membrane. This method of Voltolini, as described in the June number of the Monatschrift für Ohrenheilkunde

for 1874, consists simply in applying a cauterizer of the "size of two fine pins" to the desired spot cold, and then making the connection. In an instant the perforation is accomplished. The pain is usually slight, but he remarks on the liability of the patient to faint. The perforation is to be made posteriorly in the neighborhood of the fenestra. His experience with the operation, which is large, has been a favorable one, as in most of his cases there was improvement of hearing, though sometimes but slight, while troublesome tinnitus was mitigated. He advises great caution in the use of the cauterizer, as it easily melts.

In the August (1874) number of the same journal, Voltolini describes his small portable battery for galvano-caustic operations on the ear, and relates a case in which, by its aid, he succeeded in removing a foreign body from the external meatus that he had failed to extract by other means.

At the meeting of the Society of Naturalists and Physicians at Breslau, September, 1874, Voltolini presented a patient who had worn his ring-formed canula fastened around malleus handle for a year, and another four months, without any annoyance, and one of the patients with decided improvement of hearing.

Dr. Beverhaut Thompson, of New York, describes an artificial membrana tympani with which he has obtained better results in the improvement of hearing than with the forms commonly in use. It consists of a thin ring of silver over which gold-beaters' skin is stretched and secured in place by a small rim of silver which fits over the ring. To the side of the ring is attached a little rod or pin by which it is introduced.

Gruber, in an article on the artificial drum membrane, speaks of a modification employed by him, which is simply a plate of thin rubber cut out of a sheet with a circular punch and attached to a silk thread. He considers it superior to the ordinary form with wire attachment, as less likely to tear out, as free from the danger of accidents, and as not unsightly. He believes it to be a useful means of protection to the exposed parts of the middle ear.

Dr. Burnett reports a case of movable exudation in the tympanic cavity, of interest from the fact that the diagnosis was aided by the subjective symptoms. There was nothing positively abnormal in the appearance of the affected ear, but besides hardness of hearing the patient had a feeling as of a drop in the ear. These symptoms, it was noticed, were relieved on lying down, but came on again on rising, and varied likewise on varying the position of the head. Treatment by the catheter, continued for some weeks, gave only partial and temporary relief, but a free incision of the membrana tympani in the posterior lower quadrant, resorted to as soon as the above symptom was mentioned, and followed by inflation, gave exit to fluid, and the feeling was at once and permanently relieved, and the hearing restored. The membrane, on being touched by the knife, failed to give the usual sensation of an isolated, tightly-stretched membrane, but felt doughy and inelastic. It is suggestive that this fact might be utilized in assisting diagnosis by percussing the membrana tympani with a probe, the sensation communicated helping the judgment as to the presence or absence of fluid pressing against it.

Dr. Hagen states that in a number of cases of serous exudation into the cavity of the middle ear he found as a constant symptom a peculiar clinking sound (klingendes Geräusch), heard by the patient in the affected ear when percussion was made with the finger on the patient's head. This could not be heard as an objective sound through the auscultation tube. The sound was not heard after removal of the fluid by the tympanic catheter, but was at once noticed again when the fluid was blown back through the catheter into the cavity of the middle ear. He regards this symptom as so unfailing in such cases that he would rely upon it unhesitatingly where circumstances rendered the diagnosis otherwise doubtful. He says that it does not occur in cases of other than serous accumulations in the middle ear.

Dr. Blake, in speaking of these observations of Hagen,

states that he has practised percussion of the skull in this way, and recommended its use in diagnosis in his lectures for the past two years. He says that the peculiar metallic sound may be heard by the surgeon with the diagnostic tube. He made experiments on the cadaver by injecting the middle ear and mastoid cells with fluid, and found that the same sound was heard through the diagnostic tube. When the mastoid cells alone were filled with fluid the sound was much less marked than when the middle ear was filled to the level of the mastoid antrum, and it was most marked when both cavities were completely filled. The sound was not observed, or in a much less degree, where the consistency of the fluid was increased beyond that of ordinary serous accumulations.

Dr. Burnett records the observation of an objective noise in the right ear of a patient under treatment for chronic suppurative inflammation of the left middle ear. It was like the snapping of the finger-nails, most audible when the listener placed his ear near the right ear of the patient, but it could be heard at the distance of ten feet; was not heard on the left side, but was distinctly heard by the ear approached to the right nostril. This had continued for several months without serious annoyance to the patient. A slight retraction of the membrana tympani at its anterior superior quadrant, synchronous with the snapping sound, was perceptible on inspection, and a manometer fixed in the external meatus showed a negative fluctuation of half a millimetre at each sound. There was also at the same time an elevation and retraction of the velum palati. The writer regards as correct the opinion of Politzer that the cause of the sounds is the sudden separation of the anterior from the posterior wall of pharyngeal portion of the Eustachian tube, due to a spasmodic contraction of the muscles of the velum palati. A case in which this snapping sound was heard distinctly on both sides at the distance of several feet, but in which there was no visible motion of the membrana tympani or of the velum palati, was recently seen by the reporter at the Brooklyn Eye and Ear Hospital.

In a subsequent communication, Dr. Burnett reports that a perforation of the drum membrane of the ear in which the snapping sound was heard, afterwards occurred, and the noise soon ceased. He suggests that artificial perforation be resorted to in cases where this sound gives great annoyance.

In cases of exudations in the middle ear without acute inflammation Politzer says that absorption is very slow and the fluid may remain for months. He has formerly shown that the air-douche improves the hearing in catarrhal affections of the middle ear, not by removal of secretions, but by relieving abnormal tension of the membrana tympani and ossicles; and he thinks such removal impossible when the head is in the upright position. On this account he recommends that in using the air-douche in such cases the head be inclined to the side opposite to the affected ear and slightly forward, so as to put the Eustachian tube in a more nearly vertical position and thus favor the escape of fluid collections in the tympanic cavity. As an evidence of the correctness of this supposition, he speaks of several cases in which after using the air-douche in this way, a considerable quantity of serous fluid came from the corresponding nostril, and the ear was found to be entirely free.

Gruber proposes, for the more complete removal of fluid accumulation from the tympanic cavity, the use of an instrument like a syringe, with a long, curved nozzle for introduction through the membrana tympani, and an attachment by which the piston can be more readily drawn out so as to suck from the cavity the fluid it contains.

Dr. Rankin, of New York, reports four cases of chronic suppurative inflammation of the middle ear treated by insufflation of finely powdered iodoform, with the most satisfactory results. In three of these cases the other usual means of treatment, thoroughly applied and long-continued, have failed to stop the discharge, — a result which the iodoform effected in two or three weeks. It was applied every day, or every other day, after thorough cleansing and drying of the parts. Very satisfactory results have been obtained by the

reporter in some cases at the Brooklyn Eye and Ear Hospital and with private patients, by the use of this agent.

Salycillic acid, which has recently been made available for therapeutic use, and of which much has been expected, although tried in numerous cases, has not, so far as the reporter is aware, proved of any special value in the treatment of otorrhœa, except as a deodorizer.

Gruber reports a case (the second of the same nature seen by him) of separation and removal of the entire annulus tympanicus, together with a considerable portion of the squamous portion of the temporal bone adherent to it. The patient was a scrofulous and syphilitic child of twenty-two months, which since it was two months old had a discharge from the left ear with facial paralysis. In spite of its irregular shape, the bone was easily removed through the external meatus with the forceps, without the necessity of using the knife. Under appropriate treatment the discharge ceased, and the facial paralysis greatly diminished in the course of two months. Laminaria bougies were used to keep open the meatus.

Gruber regards the history of this case as confirmatory of the view before expressed by him that inflammation of the ear and of the temporal bone are less dangerous to life in young children than in adults, by reason of the looser connection of the parts; the sequestrum being thus thrown off earlier and before the strength of the patient has become exhausted; and also because in children a thicker wall of bone separates the inflamed mucous membrane of the mastoid from the sigmoid fossa, and opposes a more effectual barrier to the extension of disease to the brain.

Dr. H. N. Spencer, of St. Louis, reports four cases of neglected chronic suppurative middle-ear disease, in three of which death resulted from extension of the disease to the brain. In the fourth, the cochlea, with a portion of one of the semicircular canals, came away as a sequestrum, after which recovery took place.

Pflüger records three cases of caries of the temporal bone

occurring in connection with inflammation of the middle ear, in all of which very threatening symptoms were speedily and permanently relieved on opening the mastoid. This was done in two of the cases with the scalpel, and in the other with the gouge. A discharge of pus from the mastoid cells took place, and immediate relief was experienced.

Schwartze reports a case of epithelioma of the middle ear occurring in a patient fifty-five years of age who had had otorrhœa at intervals since childhood. Frequent hemorrhages from the ear began in December, 1872, and soon after a mastoid abscess formed, with caries of the mastoid process, which in the course of the year 1873 involved a large portion of the temporal bone. The patient died in November, 1873. Prof. Volkmann, who had seen the case in consultation, did not regard it as one of malignant growth; but microscopic examination of the edges of the ulcer of the cervical glands, and of the dura mater above the pars petrosa, showed the typical appearances of epithelial cancer. Very few cases of epithelioma affecting the middle ear have been reported, but this, Schwartze thinks, may be due to errors of diagnosis.

Dr. T. R. Pooley reports a case of hemorrhage from the ear occurring in connection with purpura. The patient, a little girl of four years, had previously been under treatment for otorrhœa, which had been relieved. After a time she came again with a bloody discharge, so abundant as to produce great weakness. Inspection showed thin watery blood oozing from the mucous membrane of the middle ear. The child was found to be affected with purpura, of which she died not long after.

Wreden reports a remarkable case of phlebitis affecting the sinuses of the dura mater, resulting from otitis media, in a boy of fifteen years. Severe pain in the right ear came on after intoxication and exposure to cold, with swelling, and tenderness on pressure around the ear and over the mastoid, with dizziness, staggering gait, and other symptoms, which he refers to implication of the right lateral sinus. In conse-

quence of energetic measures of treatment adopted, these symptoms were relieved, but on renewed exposure returned, with indications of further cerebral complications. According to Wreden's analysis, the right lateral sinus, with the right internal jugular vein, the superior longitudinal, the left lateral, and finally the right cavernous sinus became involved in rapid succession. The symptoms on which he bases this bold attempt at a differential diagnosis of the affections of the sinuses named are these: The extension of the phlebitis from the right lateral sinus to the right internal jugular vein was indicated by the progress of the painful swelling from the neighborhood of the ear downward to the side of the neck without redness of the skin, the points of greatest tenderness and swelling corresponding to the course of the internal jugular; the implication of the facial branches of the internal jugular was evidenced by œdema of the right side of the face, with circumscribed erysipelas bullosum upon the cheek and forehead. Further indications of phlebitis of the internal jugular were a remarkable dilation of the external jugular, with an undulatory movement corresponding to exspiration and inspiration, which he considers a characteristic symptom of thrombosis of the internal jugular vein. There were also clonic and tonic spasms of the sterno-cleido and trapezius muscles, indicating irritation of the spinal accessory nerve in the jugular foramen, due to thrombosis of the bulbus of the jugular vein. Phlebitis of the superior longitudinal sinus was marked by repeated profuse bleeding from the nose and epileptiform convulsions occurring on the same day,—the nose-bleed indicating obstruction to the return circulation in the veins of the nasal cavity, due to plugging of the longitudinal sinus, and the convulsions indicating capillary hemorrhages in the cortical substance of the convexity of the posterior cerebral lobes, caused by obstruction to the return current of blood from the surface of the brain. Inflammation of the left lateral sinus and left internal jugular vein was indicated by the same symptoms as those which characterized the implication of the corresponding vessels on the right side.

That the right sinus cavernosus was involved was manifested by irritation and paralysis of the abducens nerve (the first branch of the fifth pair) and the oculo-motorius — all these nerves being in close proximity to this sinus — and by obstruction of the circulation of the eye. Strange to say, after all these threatening symptoms the patient made a rapid and complete recovery.

Prof. Käppe, director of the Institute for the Insane at Halle, reports two cases of mental alienation which he thinks were influenced in the reflex, and to a marked degree, by existing affections of the ear. In one case there was chronic suppurative inflammation of the middle ear, with naso-pharyngeal catarrh on one side and external otitis on the other, and as these troubles were relieved by treatment the patient's mental condition greatly improved. In the other case the removal of an impacted mass in the external meatus was followed at once by relief of the mental disturbance.

Dr. Beverly Robinson discusses the question of the nasal douche in treatment of catarrh affections of the naso-pharyngeal space, and gives reasons for thinking that its efficiency in cleansing that tract has been much overrated, and that therefore those who dread the accidents to the ear they believe its use involves may discard it with the less regret.

Weber-Liel calls attention to a phenomenon he has observed in a number of cases of progressive non-suppurative disease of the middle ear, viz. attacks of neuralgic pain affecting the arm and neck on one side, accompanied by noises and other subjective symptoms in the ear, which ceased with the cessation of the pain, and could in some cases be produced by pressure on the side of the neck.

Weber-Liel reports that up to June, 1874, he has performed tenotomy of the tensor tympani on two hundred and twenty-five ears in one hundred and eighty-eight patients. Many of these cases he has had opportunities of watching for a long time after the operation. Few details are given, or statistics of the proportion of patients relieved or improved, but in general Weber adheres to the views formerly advanced

by him, — that the operation is useful in very many cases where all other means have failed in relieving obstinate tinnitus and dizziness, and in checking progressive hardness of hearing. He says that experience has taught him that in order to obtain the best results there must be systematic treatment by the catheter for from one to six months after the operation. He believes that the operation should not always be put off as a last resort, but is indicated in the commencing stages of some cases of progressive ear disease. He prefers the form of instrument heretofore used by him to the modifications of other surgeons.

Gruber states that he has performed tenotomy of the tensor tympani seventeen times, and in some cases with most favorable results.

So far as the reporter is able to learn, the impressions of American surgeons concerning this operation are not so favorable.

Dr. Howard Pinkney reports three illustrative cases of chronic middle-ear disease with, as he believes, adhesions of the auditory ossicles, in which by using a double-valved stomach-pump attached to a Siegle's speculum to draw upon the membrana tympani, he obtained very marked improvement of hearing. In two of these cases the other usual means of treatment had been tried without avail. He has used suction in a large number of other cases with varied success. The pump is worked by an assistant under direction of the surgeon, who watches its effect on the drum. "The valve of the pump connected with the rubber tube should always be open when the piston is withdrawn or while suction is being made, and closed when it is depressed, thereby opening the other valve, and preventing the air from being forced back against the drum." The instrument was used two or three times a week. The number of exhaustions at each sitting is not stated.

Dr. Roosa collates, from the records of his private practice during the last ten years, "those cases of impairment or loss of hearing in which the diagnosis of disease of the internal

ear has been made with the special object of ascertaining what they may teach and how they may be classified. They amount to sixty-five in number, out of an aggregate of 1,700, thus constituting about three and three-fourths per cent of the whole, — about the same proportion as that obtained by most modern writers, and from the statistics of institutions where ear diseases are treated. All cases secondary to diseases of the middle ear have been excluded, — for instance, suppurative affections of the labyrinth which evidently began in the tympanic cavity, and cases of tinnitus aurium having their origin in diseases of the middle ear. Patients with diseases of the internal ear, he says, do not usually complain of tinnitus as a very annoying symptom, but speak of it as a low, murmuring noise. The tuning-fork is most relied upon as a means of diagnosis. His cases are classified as follows: —

First.

Traumatic (including injuries producing mechanical damage to the terminal auditory apparatus)	4
Long-continued exposure to concussions, producing congestion and inflammation of the internal ear (telegraph operatives, 2; officers in navy, 1)	3
Boiler makers (not included in table)	8

Second.

Idiopathic (including) hemorrhage into internal ear producing ro-phy of nerve tissue	11
Inflammation of parotid gland, from which a catarrhal or periosteal inflammation extended to labyrinth	2
Cerebro-spinal meningitis, producing inflammation of the auditory nerve or labyrinth, or both	8
Scarlatina, causing an extension of pharyngeal or meningeal inflammation to the labyrinth	2
Measles, producing same effect	1
Basilar meningitis, extending to auditory nerve or labyrinth, or both	7
Primary inflammation of labyrinth or circumscribed (about root of auditory nerve) basilar meningitis	8
Internal administration of quinine, causing congestion and inflammation of base of brain and labyrinth	4
From causes unknown	14
Arrested development	1
	65

The four first cases, classified as traumatic, resulted from falls or blows upon the head, and he thinks there was an inflammatory action in the auditory nerve set up by the violence. In one of the two cases of auditory nerve disease in telegraph operators, there was tinnitus aurium, without impairment of hearing; and in the other there was great impairment of hearing in the ear that was habitually turned towards the instrument in the act of listening. Dr. Roosa believes that the constant recurrence of one kind of unmusical and unpleasant sound causes at last a congestion of the ultimate nerve-fibres in the cochlea. Boiler makers, he finds, are nearly all hard of hearing, and those who are not have taken the precaution of plugging the external meatus with cotton while at work. Those who work inside boilers as riveters, and who thus have shorter sound-waves striking upon their ears, lose their hearing power the most completely. In connection with these cases Dr. Roosa refers to the question why it is that some persons hear conversation better in the midst of noise (though they do not hear the watch farther), and says that all the explanations yet given seem to him totally inadequate.

Dr. A. H. Buck, in a note to an article in which this paper of Dr. Roosa's is reviewed, suggests what seems to him a reasonable explanation of this phenomenon. The pathological condition in the cases here under consideration is assumed to be one of rigidity, either of the annular membrane or ligament which holds the foot-plate of the stirrup in the fenestra ovalis, or of the secondary tympanic membrane covering the fenestra rotunda. Ordinary waves of sound, for instance such as are produced in ordinary conversation, are not of sufficient strength to overcome the rigidity of the annular ligament or of the secondary tympanic membrane; consequently the patient fails to hear the conversation. In the midst of loud noise, however, waves of sound are produced of sufficient strength to set the stirrup in motion in spite of the existing pathological obstacles. Once in vibration, this little ossicle, which might very properly be called the key to

the auditory chamber, can perform, with a certain degree of freedom, the subordinate vibrations called into existence by the conversation which is being carried on near by, — vibrations which are necessary to the act of hearing it; the loud tones open the door for the entrance of the lower ones. In another note to the same article, Dr. Buck suggests, as a means of obtaining in time more accurate knowledge of the pathology of these cases of nervous deafness, that all the institutions for the deaf and dumb be furnished with blank forms of questions, by means of which the aural history of each pupil could readily be obtained and placed on file; and whenever a death occurred in the institution, a competent aurist or pathologist be invited to conduct a post-mortem examination, and a full record of the result of this be filed with the history, and remain in possession of the institution, and thus in time a mass of valuable material be accumulated.

"The idiopathic cases of nervous diseases are classified by Dr. Roosa as hemorrhagic and inflammatory. The hemorrhagic or apopectiform are those which occur very suddenly." "*A priori* we should conclude that patients suffering from Bright's disease might have hemorrhage into the labyrinth, but as a clinical fact, in the few cases that have been observed of hemorrhage in cases of Bright's disease, the bleeding occurred in the middle and not into the internal ear."

Ten of the sixty-five cases were apparently of this hemorrhagic or exudative character.

In discussing the subject of inflammatory diseases of the labyrinth, the question of the influence of quinine is considered. He says, "As to the effects of quinine I am positive only on one point, and that is that large doses of quinia will aggravate a previously existing aural inflammation and place it beyond the possibility of cure." Seven of the cases reported seemed to result from an extension of inflammatory processes in the brain to the internal or *middle* ear, for Dr. Roosa believes, for reasons which he gives, that the affection of the ear which occurs in connection with cerebro-spinal

meningitis is not *always* suppuration of the labyrinth, but that the middle ear may be the part chiefly affected.

In another article Dr. Roosa reports a case of sudden loss of hearing and of tinnitus occurring in a healthy-looking man, without any apparent cause in the condition of the middle ear. This, with the want of success of previous treatment of the middle ear and the indications of the tuning-fork, pointed to disease of the nerve or labyrinth. A specific origin had not been suspected by the physician by whom the patient had been sent to Dr. Roosa; but a diffuse papular eruption on the palms of the hands and wrists, and indications of alopecia led the latter to a discovery of the fact that the patient had a chancre six months before. Under the use of mercurial inuctions and iodide of potassium the patient steadily improved in hearing and the tinnitus was relieved.

Dr. Guye, of Amsterdam, in a paper on the influence of cold and sea-bathing on the organ of hearing, advances the idea that the cases in which such bathing would be likely to do harm can be distinguished from those in which it would be advantageous by the occurrence of dizziness in the former.

Dr. Max Hubrich reports two cases, — one of absolute deafness, and the other of very high degree of hardness of hearing, occurring in two women, each seventy-four years of age; the only apparent cause for which was found on post-mortem examination to be an amyloid degeneration of the auditory nerves.

Index to the articles mentioned in the Report, arranged in alphabetical order of the authors' names.

INDEX TO PART I.

Berthold E. Ueber die Function der Bogengänge des Ohr-labyrinths. Archiv. für Ohrenheilk. No. 3. 1874.

Blake C. J. Use of the Membrana Tympani as a Phonautograph. Boston. "Med. and Surg. Journal." Feb. 1875.

Bœttcher A. Ueber die Durchschneidung der Bogengänge des Gehör-labyrinths und die sich daran knüpfenden Hypothesen. Archiv für Ohrenheilk. No. 3. 1874.

Bonnafont. Séméiologie du Vertige dans les Affections de l'Oreille. Paris. 1875.

Bonnhardt A. Zur Frage ueber die Function der Bogengänge des Ohr-labyrinths. Centralblatt. May, 1875.

Budge J. Muthmassungen ueber die Function des Musculus Stapedius. Archiv. für Physiologie. B. IX. p. 460.

Gerlach. Zur Morphologie der Tuba Eustachii, Sitzungsberichten der Physicalisch Medicinischen Societät zu Erlangen. March, 1875.

Mach E. Bemerkungen ueber die Function der Ohrmuschel. Archiv. für Ohrenheilk. No. 3. 1–2.

Mach und Kessel. Untersuchung des Ohres im Polarisirten Licht. Berlin Klin. Wochenschr. No. 48. 1874.

Mayer A. M. Researches in Acoustics. "Am. Journal Science." Nos. 44, 45, 46, 47.

Mayer A. M. The Organ of Hearing of the Culex Mosquito. "Am. Journal Science." Aug. 1874.

Mendel E. Temperature of the External Auditory Canal. Virchow's Archiv. Vol. LXII, p. 132.

Moos S. Ueber das Combinirte Vorkommen mangelhafter Perception gewisser Consonanten sowie höher Musikalischer Töne und deren Physiologischen Bedeutung. Archiv. für Augen und Ohrenheilk. Vol. IV.

Schmidt O. Gehörorgan des Heüschreckens. Archiv. für Microscop. Anat. Vol. XI, p. 2.

Utz C. Zur Histologie der hautigen Bogengänge. Monatschr. für Ohrenheilk. Jan. 1875.

Wreden R. Die Ohrenprobe als Ersatz der Lungenprobe. Vierteljahrschr. f. Gerichtl. Med. Vol. XXI, p. 208.

Zaufal E. Die Normalen Bewegungen der Rachenmündung der Eustachischen Rohre. Archiv. f. Ohrenheilk B. IX. H. 3–4.

Zuckerkandl E. Zur Anatomie und Physiologie der Tuba Eustachiana. Monatschr. f. Ohrenheilk. Nov. 1874.

INDEX TO PART II.

Blake C. J. On Peculiar Metallic Sounds indicating Presence of Fluid in Tympanic Cavity. Archives of Ophthalmology and Otology.

Buck A. H. N. Y. Medical Record, July 5, 1875. Report on Progress of Otology. Notes.

Burnett C. H. Objective Noise. Movable Exudations. Aspergillus. Philadelphia "Med. Times." Oct. 1874. April, 1875. Archives of Ophthalmology and Otology. Vol. IV, p. 1.

Cassels J. P. Myringomycosis Aspergillina. Read before Medico-Chirurgical Society. Glasgow. Nov. 6, 1874.

Green J. Orne. Aspergillus Rubens. Proceedings Boston Society of Medical Sciences in New York "Med. Journal."

Gruber. Ein Neues Verfahren zur Herausbeförderung Flüssiger Substancen aus den Räumen des Mittelohres Monatschrift f. Ohr. Dec. 1874. Zur Casuistik der Schläfebein Necrose. M. f. Ohr. Sept. 1874. Künstliche Trommelfell. Wiener "Med. Presse." Tenotomy Tensor Tympani et al.

Guye. Influences of Cold and Sea Bathing on the Organ of Hearing. Archiv. f. Ohr. Vol. IX. No. 4. p. 307.

Hubrich. Nervose Taubheit. Arch. f. Psychiatrie und Nervenkrankheit. Vol. V, p. 1.

Hagen. Die Percussion des Schadels und deren Bedeutung für die Diagnose von Exsudaten in der Paukenhöhle. Monatsch. f. Ohr. Oct. 1874.

Kipp C. J. A Case of Pearly Tumor in Both Ears. Archives Ophthalmology and Otology. Vol. IV, p. 1.

Koeppe. Reflex Psychosen nach Ohrenkrankheiten. Archiv. f. Ohr. Vol. IX, p. 4.

Pflüger. Casuistiche Beitrage. Monats. f. Ohr. Nov. and Dec. 1874.

Pinckney. A New Application of an Instrument for the Relief of Deafness, caused by Adhesions of the Ossicula. New York "Med. Journal." Sept. 1874.

Politzer A. Beitrag zur Behandlung der Mittelohr Affectionen. K. K. Gesellschaft der Aertze. Vienna. Oct. 1874.

Pooley T. R. Case of Hemorrhage from Ear occurring in Connection with Purpura. Archives of Dermatology. April, 1875.

Rankin F. H. Iodoform in Chronic Suppuration of Middle Ear. New York "Med. Journal." May, 1875.

Robinson Beverley. Nasal Douche. Paper read before New York Med. Library and Journal Association.

Roosa. A Contribution to the Etiology of Diseases of the Internal Ear. 'American Journal Med. Sciences." Oct. 1874. A Case of Syphilitic Disease of Auditory Nerve. Archives of Dermatology. April, 1875.

Schwartze. Epithelialkrebs des Mittelohres. Archiv. f. Ohr. Vol. IX, p. 4.

Smrock Joseph. Another Method of Perforating Drum Membrane. New York "Med. Record." March 27, 1875.

Spencer H. N. Chronic Suppuration of the Middle Ear in Its Relation to the Brain. Paper read before Missouri State Med. Association. April, 1875.

Thompson Beverhaut. Description of a New Ear Drum. New York "Med. Record." April 24, 1875.

Voltolini. Etwas zur Perforation des Trommelfelles. Monatschrift für Ohr. June, 1874.

Weber-Liel. Zur Frage der Heilwirkung der Tenotomie des M. Tensor Tympani. Monatschr. für Ohr. June, 1874. Zur Illustration der von mir Vorgeschlagen Methode eine Persistente Œffnung im Trommelfell zu Erzielen. Monatschrift für Ohr. April, 1875.

Wreden. Myringomycosis Aspergillina. Archives of Ophthalmology and Otology. Vol. IV, p. 1. Analysis of Remarkable Case of Phlebitis of Sinuses of Dura Mater. Archives of Ophthalmology and Otology. Vol. IV, p. 1.

A METHOD OF USING MEDICATED EUSTACHIAN BOUGIES.

BY ALBERT H. BUCK, M. D., NEW YORK CITY.

Perhaps one of the greatest obstacles encountered by the aurist in treating affections of the middle ear, in which the membrana tympani remains entire, is the difficulty of bringing his remedies in contact with the diseased mucous membrane. Almost all if not all the methods in use for applying remedies to the middle ear are liable to more or less serious objections. When even simple water, of a temperature but little below that of the body, cannot be introduced without the danger of setting up an acute and sometimes very serious inflammation of the ear, the surgeon is certainly justified in feeling some hesitation about injecting water to which some irritating substance like alum, sulphate of zinc, or nitrate of silver has been added. In the great majority of cases, it is true, no harm comes from these injections through the Eustachian catheter, either because the quantity of fluid injected is very small, or because it never enters the tympanum at all, or finally because the Eustachian tube happens to be so roomy that the products of any inflammation that may be set up readily find a way of escape. The danger, then, lies in the circumstance that an irritating fluid is introduced into what may be practically termed a closed cavity; for where the membrana tympani is perforated, we do not hesitate in some cases to introduce solutions of almost caustic strength. Aside from the question of danger, other objections may be raised against the method of injecting fluids through the Eustachian catheter. In the first place, the solution, which must be very weak, oftentimes — possibly even in a majority of the cases — does not reach the tympanum, but regurgitates back into the naso-pharyngeal space. If the orifice of the Eustachian tube happens to be filled with mucus, the injected fluid probably

goes no further than merely to bathe the lips of the pharyngeal end of the tube. In the next place, we have no certain means of knowing whether the solution has reached the cavity of the tympanum or not; for a congested condition of the membrana tympani may arise in consequence of a simple inflation with air, and it is almost impossible to determine whether the gurgling sounds heard on auscultation are due to the entrance of the fluid into the tympanum or to the commingling of air and fluid within the tube. Finally, very distressing attacks of coughing are occasionally caused by the falling of a drop of the solution upon the vocal cords or into the larynx, from the end of the catheter. All these objections apply also, though perhaps to a less degree, to the method of spraying the middle ear. In addition, however, we have the difficulty of successfully producing a spray at the distal end of the catheter. This alone is a sufficient reason why the spraying method is not likely ever to come into general use among aurists.

By means of the so-called tympanic catheter, — a small, flexible catheter which can be passed through a medium-sized Eustachian catheter, and thence through the Eustachian tube into the tympanum, — it is possible to apply fluid remedies either to the tube or to the cavity of the tympanum. The same objections, however, apply here: we cannot restrict the direct action of the remedy to the tube alone; and besides, if we employ a solution of nitrate of silver, it will be found difficult to manipulate it with sufficient ease and safety (to our clothing) for every-day use.

Vapors of different kinds can, of course, be introduced into the middle ear without any special difficulty or danger. Whether the introduction of such vapors, however, accomplishes any better results than are obtained by the simple introduction of air is a question which I am not able to answer. The points to which I desire to call attention are these: How far can we safely push our local treatment of the middle ear and Eustachian tube, and What is the safest and most effective method of accomplishing it?

The diseased process which we are anxious to abate is one that is characterized by several or all of the following conditions: increased vascularity, œdema, ulceration or simple casting-off of pus cells from the unbroken mucous membrane, increased secretion of mucus, and proliferation of the tissues. Now, the remedy which *par excellence* is able to restrain these processes, provided, of course, it be judiciously applied, is nitrate of silver. But who would think of introducing this re-agent in a free form, no matter how diluted, into a middle ear which still possessed an entire membrana tympani? This brings us, then, to another question: Is it best to make any attempt to bring our remedies into direct contact with the mucous membrane of the middle ear? While I would, perhaps, not be justified in answering the question very decidedly in the negative, I have no hesitation in saying that in my own practice I abstain from making such direct applications, preferring the safer course of restricting them to the Eustachian tube and naso-pharyngeal space. The effects produced by remedies applied to these parts are unquestionably felt by the parts situated within the tympanum, for they are directly continuous with one another, and derive their vascular and nervous supplies from the same sources. From these parts, moreover, there is an outlet, which is not likely, as in the case of the middle ear proper, to become obstructed by any undue irritation set up by our remedial applications. In other words, if we should err in applying too strong a solution to the pharyngeal and middle portions of the Eustachian tube, the inflammatory reaction is not likely to involve the middle ear.

In regard to the safest and most effective method of making these applications to the Eustachian tube, whalebone or catgut bougies, not exceeding 1 mm. in thickness and armed with cotton-wool, appear to me to fulfil all the requirements of the case. By roughening the sides of the bougie near one end no difficulty will be experienced in twisting the cotton-wool firmly round the instrument: the cotton serves not only as a soft covering for the point of the bougie, but also

as a sponge for holding a sufficient quantity of the remedy to be used.

In the next place, some suitable marks should be made along the shaft of the instrument in order that we may know when the distal end emerges from the catheter, as well as how far we have pushed it into the Eustachian tube. After arming the end of the bougie with cotton-wool, and ascertaining that the bulb thus created will pass through the catheter, our next step is to saturate the cotton with the solution to be used, and then to place the instrument within easy reach of the right hand. The catheter is next to be introduced, and when once it is in position, we are to hold it there firmly by resting the middle and third fingers of the left hand on the bridge of the patient's nose, while with the forefinger and thumb we grasp the catheter. This leaves the right hand free to manipulate the bougie, which is to be passed into the Eustachian tube a distance of about five eighths of an inch beyond the end of the catheter, or fairly to the membranous or osseous portion of the tube. The instrument should remain there for a few seconds or perhaps a minute, and then be withdrawn. After removing the bougie I usually inflate the middle ear a few times through the catheter. If, upon withdrawal of the bougie, the cotton is found to be smeared with whitish mucus, I often introduce a second bougie, in the belief that the solution on the first bougie has spent its strength on the mucus.

In introducing the bougie into the Eustachian tube, it will often be found that after passing it a distance of about a quarter of an inch beyond the distal end of the catheter, the instrument encounters some firm obstacle. In a few cases I have been unable to push the instrument beyond this point, but usually, after a little manipulation, it slips past the obstacle, and then no difficulty whatever is encountered until the narrow osseous or membranous portion is reached. At this point the finger readily becomes aware of the fact that the bulbous end of the bougie is entering a narrower portion of the tube. The moment this sense of tightness is experienced

by the finger, it is best to push the instrument no farther, for I have found that when I did so the cotton bulb almost always afterwards showed traces of blood upon it. Where the bulb of cotton, therefore, measures as much as 2½ millimetres in diameter, the sense of touch may be more satisfactorily followed as a guide than any stated measurements of distance. If on the other hand the bulb is small, the measurements on the shaft of the bougie should be consulted, as we might otherwise pass the instrument into the cavity of the tympanum before encountering any appreciable obstacle.

As already intimated, I have used in these cases nitrate of silver in preference to any other remedy. In the following reports of cases, it will be seen that, in two instances, I was able to use even the solid salt without setting up any unpleasant reaction. I doubt, though, whether any special advantage is to be gained by the use of very strong solutions or the solid salt itself. Judging from the results of the same treatment applied to the naso-pharyngeal space, I should think that a solution of from twenty to forty-five grains to the ounce of water would accomplish all that could be expected from the remedy under the circumstances we are here considering. In some cases, after using the nitrate of silver for a time, I have substituted ferric alum (℥ii to ℥vi of water).

Now, as regards the results of this plan of treatment, I have certainly nothing extraordinary to report. I can simply claim that by this method I am better able, without fear of exciting a dangerous reaction, to bring that valuable remedy, nitrate of silver, into close proximity to the middle ear than is possible by any other method known to me.

The following briefly-stated cases have been selected simply because of their value as illustrating the *average* results of treatment in every-day practice, not the *exceptionally successful* ones.

Medicated Eustachian bougies have been in use, I believe, for many years, but I am unable to say when or by whom the method here advocated was first introduced.

Case I. July 24, 1873. Male, æt. 40. Dry-goods clerk, in good health. Has been troubled for a month past with a peculiar clicking sound in the ears when swallowing or engaged in conversation. H. D. W. = R. 4-20, L. 6-20. No appreciable deafness in conversation. No tinnitus. Both memb. tymp. normal in color and texture, though slightly sunken. Follicular pharyngitis. Tubes open to Politzer's method of inflation. *Diagnosis:* Clicking sound due to a catarrh of the Eustachian tubes. *Treatment:* Application of nitrate of silver in solution (gr. xx to the ounce of water) to tubes by means of a slender wire armed with cotton; inflations through catheter; applications of nitrate of silver (same solution) to naso-pharyngeal space. Eleven applications, on alternate days. Moderate pain in ears for a few hours after the fifth application. Air passes very freely through both tubes. Hearing distance the same. Clicking sound entirely removed.

Case II. Female, æt. 35. In good health. Four months previous began to be troubled with tinnitus in R. ear, associated with slowly increasing deafness. H. D. W. = R. 0.5-20, L. 6-20. Air passes very imperfectly through the right tube; R. memb. tymp. sunken and of a dull, greenish hue; fauces congested. *Diagnosis:* Otitis media catarrhalis and Eustachian catarrh. *Treatment:* Bougie with solution of nitrate of silver (gr. x to the ounce) to tube on alternate days; nitrate of silver (gr. xx—ʒ j aquæ) to naso-phar. space; inflations through catheter. Eleven applications. H. D. W. = R. 6-20. Tinnitus almost gone. Politzer's method continued for a few days longer, and tinnitus entirely relieved. At no time pain following applications.

Case III. Female, æt. 40. In good health. Slowly increasing deafness with tinnitus during past four or five years. H. D. W. = R. 0.25-20, L. 0.33-20. In conversation with her I am obliged to raise my voice. Both memb. tymp. opaque; cicatricial spots. Air passes with difficulty through tubes. *Diagnosis:* Otitis media catarrhalis chronica. *Treatment:* Bougies with 20-grain solution of nitrate of silver: inflations through catheter; applications of silver solution (same strength) to naso-phar. space. Ten applications in the course of two weeks. Air passes very freely through both tubes. No improvement appreciable in either the hearing or the tinnitus.

Case IV. Male, æt. 47. In vigorous health. Constant and very distressing tinnitus in left ear (chiefly) for past eighteen months. No appreciable deafness for conversation. H. D. W. = R. and L. 0.33-20. Right tube open, left closed to Politzer's method of inflation. Rhinoscopic examination shows mouth of left tube very much swollen and red. *Diagnosis:* Otitis media catarrhalis chronica with Eustachian catarrh (L.). *Treatment:* Bougie with silver solution (gr. cxx — ʒ i aquæ) to left tube daily; silver solution (gr. xx ʒ i) to naso-phar. space; inflations through catheter. Ten applications and then a respite of two weeks, followed by ten more applications. Left tube freely open to catheter and Politzer's

method; tinnitus still present, but very markedly diminished; hearing distance unchanged. On one ocaasion, instead of using the bougie with a 120-grain solution, I substituted a slender wire, on the end of which the nitrate of silver had been fused in the form of a solid bead. This was passed through the entire length of the tube Neither this nor any of the other applications was followed by more than momentary pain.

Case V. Male, æt. 51. In rather poor health. Two years previous hemiplegia. For past three years constant tinnitus in the right ear. No noticeable deafness for ordinary conversation. H. D. W. = R. 0.5-20, L. 1.5-20. Marked naso-phar. swelling and congestion. Both memb. tymp. opaque. *Diagnosis:* Otitis media catarrhalis chronica. *Treatment:* Bougies with nitrate of silver (at first gr. xx, afterwards gr. lx to the ounce of water) on alternate days; inflations and usual naso-phar treatment. Six applications. Tinnitus appreciably diminished but not entirely removed. H. D. W. = R. 1.5-20.

Case VI. Male, æt 23. In vigorous health. Two months previous became decidedly deaf in the right ear, without any special pain. Was suffering at the time from a pretty severe nasal catarrh H. D. W. = R. C-20. Memb. tymp. of a milky hue, almost calcareous in appearance; peripheral and manubrial plexuses of vessels markedly congested; upper part of pharynx red and swollen. Politzer's method unsuccessful. *Diagnosis:* Otitis media catarrhalis (with exudation into tympanum) and Eustachian catarrh. *Treatment:* free vertical incision through posterior half of memb. tymp., followed by Politzer's method of inflation, which was then successful in driving out into the meatus, and even out as far as to the lobe of the ear, a pinkish mucus of but slight viscidity; nitrate of silver (gr. xx to the ounce) to naso-pharyngeal space. The following day, the incision having healed in the mean time and the fluid being apparently as abundant as before, the incision was repeated. The amount of fluid evacuated was the same and the improvement in hearing as marked as after the first incision. On the third day, same accumulation of fluid, same treatment, same results. The following six days: Politzer's method, inflation through catheter, — both of which were invariably unsuccessful, — and application of nitrate of silver to the naso-pharynx. On the tenth day after I first saw him, passed bougie (nitrate of silver, 120 gr. to the ounce) through R. tube. Eleventh day, passed wire with bead of the solid salt; also applied solid stick to naso-pharyngeal space. Repeated the same on the twelfth, thirteenth, and fourteenth days On the fifteenth day patient complained of soreness of throat in swallowing. Tried air-douche (Politzer) and was able to inflate R middle ear. Sixteenth day, air-douche alone. Soreness of throat nearly gone; air enters middle ear freely. H. D. W. = R. 4-20. Whispered words heard correctly in R. ear a distance of thirty feet. Peripheral and manubrial portions of memb tymp. still a little congested, but the central portions have recovered their natural transparency.

Case VII. Male, æt. 7, healthy, measles four years before, followed by otorrhœa from both ears. Constant discharge. R. ear: medium-sized central perforation; no granulations; discharge moderate in quantity. L. ear: large central perforation; mucous membrane swollen and showing some tendency to the formation of granulations; discharge abundant. *Diagnosis:* Otitis media purulenta chronica: *Treatment*: Application of nitrate of silver (solid bead on probe) daily to visible mucous membrane of both middle ears; application of the same in solution (gr. xx to the ounce) to the naso-pharyngeal space Three applications made. During the three following days substituted powdered alum for the solid nitrate of silver. Discharge still present, though decidedly less than before. On the seventh day passed bougie (nitrate of silver. gr. lx to the ounce) through both tubes as far as to tympanum. No pain, except on left side while withdrawing bougie. The instrument passed in easily but seemed to be grasped pretty firmly by the walls of the tube when I attempted to remove it. No subsequent pain. Same treatment repeated on the eighth day, although both ears had ceased to discharge. Patient returned ten days later; both ears still remained dry, there being simply enough secretion to keep the mucous membrane of the middle ear moist. No evidence of any attempt at repair of the perforations in the membranes.

The boy was to have been brought to me again in case of relapse, but as he has never appeared, I am disposed to believe that the discharge was permanently checked.

Case VIII. Male, æt. 11, healthy. Moderate deafness and tinnitus in L. ear for some time past. No recollection of ever having had a discharge from either ear. L. membrana tympani opaque and very much sunken. R. ear normal. Air enters left tympanum through catheter, but not very freely. After inflation H. D. W. = L. 0. 5-20, while before it was C–20. Tonsils moderately enlarged. *Diagnosis*: Otitis media catarrhalis chronica with slight Eustachian catarrh and probably retraction of the tensor tympani tendon. *Treatment:* Bougie with solution of nitrate of silver (gr. cxx to the ounce), introduced only once; inflations; applications of nitrate of silver (gr. xx to the ounce) to the naso-pharynx. The patient reported on the following day that after leaving my office (6 P. M.) his left ear began to ache and that the pain had continued up to about midnight. On examination at this second visit, the L. memb. tymp. was found to present precisely the same appearance, as regards vascularity, transparency, and position, that it did when first examined. The applications to the naso-pharynx and Politzer's method of inflation were continued daily for a week longer, but without any appreciable benefit. The improvement in hearing following inflation lasted but a few minutes, and to the naked eye the membrana tympani always appeared to maintain the same markedly sunken position.

Case IX. Male, æt. 10, healthy. Moderate deafness, for, perhaps, a year past; recently aggravated by the measles. H D. W. = R. 0 5-20, L. 1-20. Naso-pharyngeal catarrh, with moderately enlarged tonsils.

Both memb. tymp. dull and opaque, but not appreciably sunken. *Diagnosis:* Otitis media catarrhalis chronica. *Treatment:* Bougie with nitrate of silver (gr. lxxx to the ounce); naso-pharyngeal applications; inflations through catheter, repeated daily for ten days. Afterwards daily inflations (Politzer) and naso-pharyngeal treatment for eight days. H. D. W. = R. and L. 4-20. Conversation heard perfectly well, so far as the parents can judge.

Case X. Female, æt. 7, healthy but not robust. During past two weeks has been suffering from a severe naso-pharyngeal catarrh. About a week ago she had a moderately severe ear-ache, lasting the greater part of one night, and followed by pretty marked deafness. No otorrhœa. H. D. W. = R. and L. 0.1-20. In conversing with her I am frequently obliged to repeat what I say. Both memb. tymp. sunken. Manubrial and peripheral portions red, while the central are of an almost chalky appearance. Politzer's method unsuccessful. Pharyngeal mucous membrane red and somewhat swollen. Patient breathes chiefly through her mouth. *Diagnosis:* Otitis media catarrhalis acuta with Eustachian catarrh. *Treatment:* Bougies with nitrate of silver (120 gr. to the ounce) daily; nitrate of silver (gr. xx to the ounce) to the naso-pharynx; inflations through catheter. Four applications made. No pain. Marked improvement in the hearing, H. D. W. = R. and L. 5-20. Both membranes nearly normal, the chalky appearance having disappeared; the peripheral and manubrial portions, however, are still moderately congested. Patient can now breathe through her nostrils. Politzer's method is now successful; bougies, therefore, discontinued. During the night of the seventh day (counting from the first visit), probably from having exposed herself at night while returning from a party, she suffered with a pretty severe ear-ache (in both ears). *On the eighth day* I found her again quite deaf, though free from pain. R. memb. tymp. convex outwardly from accumulation of fluid beneath dermoid layer. A small puncture gave escape to a serous fluid. No communication demonstrable between this cavity and that of the tympanum. Râles audible on both sides during inflation through catheter. Bougies resumed.

On the *eighteenth day*, finding that the râles continued and that there was no improvement in the hearing, I incised both membranes and evacuated by inflation a drop or two of thin, only slightly tenacious mucus. Immediately afterwards H. D. W. = R. and L. 4-20. Conversation heard with perfect distinctness. During the following six days the incision was repeated three times on each side, and each time the amount of mucus evacuated was about the same as at first. Bougies continued in the mean time, with nitrate of silver (gr. lx to the ounce). On the *twenty-fifth day*, there being no evidence of improvement, incised the left membrane, and by pressure with finger forced a ten-grain solution of nitrate of silver through tympanum into Eustachian tube. As soon as patient tasted the solution, the pressure was withdrawn, inflations by Politzer's method administered, and ear syringed with lukewarm water. *Twenty-sixth day.* Instead of a mucous secretion there is now a purulent one. No pain

following introduction of solution. Repeated the operation with a 20-grain solution, also incised the R. membrane, evacuating a scanty drop of mucus, decidedly less than after previous incisions. Politzer's method entirely successful on both sides. Bougies stopped. *Twenty-eighth day.* Hearing steadily improving on the R. side. On the left side there is still a slight purulent discharge through a small perforation. Forced a 60-grain solution through into tube. *Twenty-ninth day.* Pain only for a short time after last application to left ear. Discharge still present. *Thirty-fifth day.* Since last date treatment has been restricted to inflations (daily) by Politzer's method and applications of a 20-grain solution of nitrate of silver to the naso-pharyngeal space. Discharge has ceased entirely on the left side; a small scab still remains at seat of former perforation. H. D.W. = R. 2-20 L. 1-20. Whispered words heard correctly a distance of thirty feet. No trouble whatever now in hearing ordinary conversation. Active treatment stopped.

Looking at the case retrospectively, I am disposed to believe that the left ear would have improved more rapidly had the intra-tympanic applications of nitrate of silver been omitted.

Case XI. Female, æt 4. Healthy. Deafness, pretty well marked, of nearly a year's standing. No pain, no discharge, except about a year before. Both memb. tymp. sunken, uniformly congested, and swollen. Landmarks barely recognizable. Air passes with difficulty through tubes. Tonsils moderately enlarged. *Diagnosis:* Otitis media catarrhalis chronica with Eustachian catarrh. *Treatment:* Bougies with a 20-grain solution of nitrate of silver; inflations; applications of the 20-grain solution to the tonsils and naso-pharynx. Five applications in all of the bougie to each tube, never followed by pain. Bougies then stopped, as air passed freely through both tubes. Politzer's method and applications to naso-pharynx continued for a few days longer. Both membranes have nearly resumed their natural appearance. The parents experience no difficulty in communicating with the child.

Case XII. Male, æt. 54. Healthy. Double tinnitus of several years' standing. Steadily increasing deafness. No pain; no discharge. H. D. W. = R and L. 0-20. Am obliged to raise my voice in conversing with him. Both tubes imperfectly pervious to air. Pharyngeal mucous membrane red and plastered with mucus; enlarged follicles. Memb. tymp. presented nothing special. *Diagnosis:* Otitis media catarrhalis chronica. *Treatment:* Bougies with a 20-grain solution of nitrate of silver, on alternate days; 60-grain solution to naso-pharynx and pharynx; inflations. Seven applications in all. Tinnitus very much diminished in intensity, though not entirely relieved. H. D. W. = R. and L. c-20.

Case XIII. Male, æt. 20. Healthy, but suffers often from nasal catarrh. For past few days has suffered from moderate deafness in both ears. No pain; no tinnitus; no discharge. H. D. W. = R. and L. 0.75-20. Upon inflation according to Politzer's method the air passes

through the left tube, but not through the right After the inflation patient complained of a permanent sense of fulness in the left ear. Pharyngeal mucous membrane red and somewhat swollen. R memb. tymp. of a dull, leaden hue, not appreciably sunken nor congested. L. membrane presents about the same appearance, except that in the posterior superior quadrant a curved line stretches like a hair from the middle of the manubrium to the periphery of the membrane. This line maintains its horizontal position, whatever be the position of the patient's head. *Diagnosis:* Otitis media catarrhalis sub-acuta and Eustachian catarrh, with serous exudation in the left tympanum. *Treatment:* Evacuation of contents of left ear through an incision in posterior half of membrane; bougie with a 20-grain solution of nitrate of silver; same solution to be applied to naso-pharynx; inflations. Two applications of bougie. No return of fluid. Both tubes easily pervious to Politzer's method. No difficulty in understanding conversation. Nasal catarrh still continues. H. D. W. = R. 2-20, L. 3.5-20

Case XIV. Male, æt. 33 Healthy, and not a sufferer from nasal catarrh. Marked deafness of ten years' standing No tinnitus. Hearing varies to a certain extent with the weather. Am obliged to speak quite loudly to him. H. D. W. = R c-20, L 0-20. Vibrations of tuning-fork, conducted through cranial bones, scarcely heard at all. Air passes through both tubes, though not freely Both membranes nearly normal in appearance No appreciable pharyngitis. *Diagnosis:* Otitis media catarrhalis chronica, probably with anchylosis (incomplete) of stapedo-vestibular joint or rigidity of membrana tympani secundaria. *Treatment:* Bougies daily with a 20-grain solution of nitrate of silver; solution of same strength to naso-pharynx; inflations. Ten applications. No improvement whatever. No appreciable increase in size of tubes, as ascertained by auscultation.

Case XV. Male, æt. 50, health poor. Three months before began to suffer from deafness and tinnitus in the left ear. No pain; no discharge H. D. W. = R. 10-20, L. c-20. Vibrations of tuning-fork referred very decidedly to the R. ear. R. tube open freely to Politzer's method, left closed. Pharyngeal mucous membrane swollen and covered with mucus. Both memb. tymp. nearly normal in texture and position. *Diagnosis:* Nature of trouble not clear. *Treatment:* Applications of nitrate of silver (gr. xx to the ounce) to the naso-pharyngeal space on alternate days. These applications were continued for about two weeks by the patient's physician and resulted in affording him entire relief from the tinnitus. Eight weeks later patient returned for further treatment. The tinnitus, he said, had returned, and was as bad as ever. The left membrane was found, on examination, to be somewhat red throughout the manubrial and peripheral portions, while the intermediate portions presented a dull and œdematous appearance. Bougie with a 20-grain solution of nitrate of silver applied to left tube on alternate days; same solution to naso-pharynx; inflations. Five applications. Tinnitus entirely relieved. Pharynx of a decidedly healthier appearance. Memb. tymp. free from all redness and œdema. H. D W. = L. 0.5-20.

INTRA-TYMPANIC PRESSURE DURING PHONATION.

CLARENCE J BLAKE, M. D., BOSTON.

The two principal factors in the production of articulate sounds being the expulsion of air from the lungs, and the variations in position of different parts of the larynx, naso-pharyngeal and buccal cavities, changes in the degree of pressure in these cavities necessarily result and play an important part in the production of articulate sounds.

This subject has been considered by Dr. Henry J. Bigelow, in his experiments on articulation in cases of cleft palate, as the result of which he has given rules for practice in phonation which should enable the patient, by varying the pressure in the buccal cavity, to accommodate the position of the tongue and lips to the abnormal condition of the roof of the mouth, and thereby increase the clearness of articulation.* It is evident that under normal conditions the changes in the contour of the buccal cavity during phonation result in corresponding variations of pressure in the mouth and in the naso-pharyngeal space; and the case in which the following tests were made proves conclusively that this pressure is sufficient to be communicated through the Eustachian tube to the middle ear: —

The patient, a man thirty years of age, had a purulent inflammation of the left middle ear, the result of an attack of scarlet fever in his fourth year. Up to the time when first examined, the purulent discharge had continued, in varying quantity, for twenty-four years. Examination of the ear showed almost entire destruction of the membrana tympani, and a granular condition of the mucous membrane of the tympanic cavity, with well-marked polypoid granulations about the head of the malleus and incus, and hanging down into the cavity. As the result of careful cleansing, the use of

* Boylston Prize Dissertation, 1844.

astringents, and the application of caustics, the granulations disappeared, the discharge diminished, and a cicatricial growth, starting from the periphery of the membrane and from about the malleus, formed a septum between the lower and anterior portion of the tympanic cavity and the outer ear.

This septum, as is the case in cicatrices of the membrana tympani, was thinner than the membrana tympani itself, and its larger segment, extending across the anterior portion of the tympanic cavity oppósite the opening of the Eustachian tube, was exceedingly lax and could be easily made to bulge outward by forcing air up through the Eustachian tube.

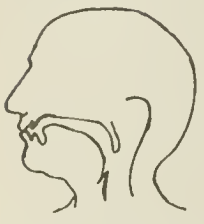
About the 1st of June, 1875, the patient appeared, speaking very much as if he were suffering from a "cold in the head"; that is, the m, n, and ng sounds were pronounced b, d, and g; "manner," for instance, was pronounced "badder," with a very slight nasal sound, and "managing," "badagig." There were no other symptoms of a cold, however, and he explained the peculiar pronunciation as a voluntary effort to suppress the nasal sounds, m, n, and ng, substituting the corresponding media, because the former were accompanied by a very disagreeable crackling and bursting sound in the left ear. This sound was less on pronouncing m, greater on pronouncing n, and most disagreeable of all on pronouncing ng. An examination of the left ear while the patient sounded the nasal checks, showed that, with each sound, the lax cicatrix extending across the tympanic orifice of the Eustachian tube executed a corresponding movement. With m, the membrane made a slight excursion outward and fell back into its former position; with n, the excursion was still greater; and with ng, a double excursion was observed, the membrane only partially resuming its original position between the two movements. The movements of the membrane as to duration and extent of the excursion being represented by the following curves, which correspond very nearly to the logographic tracings of m, n, and ng, — thus, m, n, ng,

By pressing a probe against the membrane its excursions were partially controlled, and the unpleasant sensations in the ear correspondingly diminished. A piece of cotton tightly packed at the bottom of the meatus was still more effectual, but this improvement lasted only a few hours, as the cotton was easily displaced. As a final remedy, a portion of the membrane was excised, leaving a circular opening, through which air forced through the Eustachian tube passed freely. The movements of the membrane immediately ceased, the nasal sounds were pronounced clearly and with the usual resonance; and the opening remaining, up to the last examination, there had been no return of the unpleasant symptoms in the ear, and the voice was as clear as usual.

Immediately after the operation and for the purpose of experiment, a manometer made of barometer tube bent into U form, and having a bore 1 millimetre in diameter, filled with water, was inserted in the outer ear, closing the opening. The pronunciation of the nasal checks produced a movement in the column of fluid exactly corresponding to the movement of the membrane before perforation: for the m sound, there was a rise and fall of the column $\frac{1}{2}$ millimetre; for the n sound, a rise and fall of nearly 1 mm.; and for the ng sound, a double rise and fall for nearly the same degree. The tube was then placed in one nostril and the other nostril closed; for the m sound, the column rose 16 millimetres, for the n sound, 20 mm., and for the final impulse of the ng sound, with the same double movement as before, 26 millimetres.

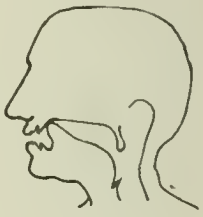
The same test, in a patient having no perforation of the membrana tympani, showed the same proportion of movement for the several nasal checks The movements of the membrane in the case described, and of the manometric column, when the tube was placed in the ear, show a certain pressure in the naso-pharyngeal space, corresponding to each of the three nasal sounds, and an examination into the position of the lips, tongue, and palate, in the production of m, n, and ng, shows a corresponding diminution of the capacity of the

buccal cavity. Thus, in producing m, the position is as follows: —

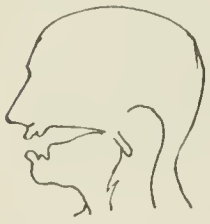


The lips closed and tongue depressed. The capacity of the buccal cavity being considerable, and the pressure in the naso-pharyngeal cavity correspondingly small. This is shown by the lesser movement of the membrane in the ear, and of the fluid column in the manometer.

In producing n, the lips are slightly apart, and the tip of the tongue pressed against the hard palate, just behind the teeth. The capacity of the buccal cavity is diminished, and the pressure in the naso-pharyngeal space proportionately greater, as shown by the greater movement of the membrane in the ear and the manometric column.



In producing ng, the top and back of the tongue are pressed upward, still further diminishing the resonant capacity of the buccal cavity, and allowing the full force employed in the production of the sound to expend itself in the nares and naso-pharyngeal cavity, back of the elevated tongue.



Helmholz says, "m and n resemble the vowels in their formation, because they cause no noise in the buccal tube. The buccal tube is shut and the voice escapes through the nose. The mouth only forms a resonating cavity modifying the sound." As we have seen, in m the buccal cavity is closed at its farthest anterior limit by the lips, and the cavity has full resonance. In sounding n, it is closed by the tip of the tongue a little farther backward and its resonant capacity diminished, while in the full nasal sound, ng, it is closed at its posterior limit by the elevation of the top and back of the tongue, and its resonant capacity is very little.

Merkel* tested the pressure in the nasal cavity by holding a bit of down or a light feather in front of the nostrils. On sounding a pure vowel the feather remained motionless, the

* Der Kehlkopf, p. 268.

air passing out through the buccal cavity; but on sounding a nasal tone, the feather was set in motion.

Max Müller* says, b, d, and g, may be modified to m, n, and ng; for these nasals a full contact takes place (that is, of lips or tongue and roof of mouth), but the breath is stopped, — not abruptly (as in p, t), but in the same manner as with the media (as in b, d, g), — at the same time the breathing is emitted through the nose. In the present case the unpleasant sensation in the ear caused the patient to seek relief by substituting the media, b, d, and g, for the nasal tones, thus allowing the air to pass out through the mouth and diminishing the pressure in the pharynx and Eustachian tube and ear. In the formation of the nasal tones, in this case, it has been interesting to note an increase of pressure in these parts proportionate to the degree of closure of the buccal cavity; and the case suggests a series of tests of the distribution of pressure in the formation of consonant sounds, which would certainly be of interest and possibly of value.

A CASE OF ANGIOMA CAVERNOSUM OF THE LOBULE OF THE EAR.

BY CHARLES J. KIPP, M. D., NEWARK, N. J.

Mr. A. A. S., æt. 50, in good health, consulted me with regard to a tumor of the left auricle. He stated that about twelve years ago his ears were frost-bitten, and that soon afterwards he noticed a bluish spot on the outer side of the lobule of the left ear. Since then this spot has gradually grown to its present size. About a year ago he consulted a medical gentleman with reference to this growth, who injected about 5 min. of Tinct. Ferri chlor. into the tumor. This injection was followed by considerable inflammation of the whole external ear, and, as the patient thinks, by a more rapid growth of the tumor. He has never experienced any pain in the tumor

* Science of Language, p. 158.

or in the external ear, but after unusual exercise the lobule often feels hot and heavy. The entire lobule is somewhat hypertrophied, and on the lower portion of its anterior surface is seen a dark bluish protuberance of a semi-globular shape. Its size is about that of a hazel-nut. The tumor is situated beneath the skin, which is movable over it, and traversed by numerous enlarged veins. By pressure the tumor can be greatly reduced in size, but it soon regains its former dimensions after the pressure is removed. Extirpation of the tumor was at once proposed to the patient, and a few days later the operation was performed in the following manner. The lobule having been fastened in an ordinary entropion forceps (to control hemorrhage), an incision was made parallel and close to the lower border of the lobule. The skin was now carefully dissected from the tumor, and when the latter was fully exposed, the knife was carried behind it and its connection with the subcutaneous tissue severed. There was absolutely no hemorrhage. The wound healed by first intention, and the appearance of the lobule is now the same as that of the opposite ear. More than five months have passed since the growth was removed, and as yet there are no indications of a relapse.

The anatomical examination showed that the tumor was covered by a moderately dense fibrous capsule, which was intimately connected with the subjacent tissue. The tumor itself was composed of a spongy tissue, similar to the corpus cavernosum penis. Under the microscope the growth was seen to consist of a network of connective tissue trabeculæ. The walls of the spaces enclosed by the latter were lined with a layer of endothelial cells.

AURAL CONTRIBUTIONS.

BY GEO. STRAWBRIDGE, OF PHILADELPHIA.

Congenital Malformation of the External Ear.

The case was a boy æt. 14, whose right external ear was represented by a fold of integument 22 m. m. long, 16 m. m. wide, in which could be felt a small portion of cartilage. This narrowed down to a small, rounded extremity representing the lobule. In the centre of this fold was found the rudimentary external canal, a narrow passage leading onward a distance of 6 m. m. and ending in a cul-de-sac.

Above the main fold was a second smaller skin fold, containing also cartilage. The entire temporal and molar region was very much flattened.

The watch and tuning-fork, held in close contact with this rudimentary ear, could be heard; also, by contact with the temporal and mastoid regions.

The case, therefore, would represent a malformation, chiefly characterized by incomplete development of the auricle and external auditory canal.

The left ear was well developed, but with greatly reduced hearing power.

Cases of malformation of the external ear are not uncommon; often, however, the helix is wanting, also the lobule. The concha is found convex, instead of concave; the external auditory canal so narrow as to scarcely admit a probe; again very wide. Some cases are recorded where the external canal ended in a cul-de-sac. A case of this kind applied to me this year. Several cases are reported of imperforated meatus without abnormality of the auricular cartilage.

Prof. Mussey records a most interesting case of "absence of the meatus auditorius externus, without much impairment of hearing" (in the "American Journal of Medical Science," Vol. XXI, p. 378, 1837). Both auricles were smaller than natural and imperfectly developed. There was

no vestige of meatus, not even an indentation. The whole ear was covered by integument, yet the hearing was sufficiently good to allow the man to carry on his business of a bookseller, as he could hear moderately loud conversation. By covering the scalp with a layer of cloth, except a small portion at the anterior and upper part, leaving the face and ear bare, the hearing power was depressed, and much more so than by covering the face and ear and leaving out the scalp, showing the marked conducting power of the cranial bones.

Cassebohm reports the curious case of a child with four ears, two naturally placed, and two lower down on the neck; also there were two petrous portions to each temporal bone.

Prof. Allen Thompson, in a paper on this subject, published in the "Edinburg Journal of Medical Science," April, 1847, records the following deviations from the natural form as the most prominent: —

"1. An incomplete development of the integumental part of the apparatus, viz. the external auricle and outer parts of the meatus.

"2. The absence of the membrana tympani ring and bony part of the meatus in consequence of the incomplete development of the tympanic bone, or a part of this structure which in the lower animals bears that name.

"3. The defective state of the cavity of the tympanum and chain of small bones.

"4. Occasional irregularity or deficiency in the development of this molar-palatal and maxillary portion of the face."

In a great majority of recorded cases of malformation, sufficient hearing power has existed for the ordinary affairs of life.

Operative effort to improve the condition has proved of little avail.

Fibro-Cartilaginous Tumor of the Lobule.

This case represented fibro-cartilaginous tumor of the lobule, occurring in a negro woman, and of two years'

growth. The tumor's length was 36 m. m. and the breadth on its base was 30 m. m. The fissures, two in number, existing in it were due to tearing of the lobule by very heavy ear-rings. The microscope showed the growth to be fibro-cartilaginous.

I have seen a considerable number of these growths, and invariably found them occurring in colored women, and without doubt, the result of irritation of the lobule, produced by piercing it for the use of ear-rings.

A CASE OF MULTIPLE ABSCESS OF THE AURICLE RESULTING IN PARTIAL DESTRUCTION OF THE CARTILAGE, DEVELOPED FROM A MIDDLE AND EXTERNAL OTITIS, AND SOMEWHAT RESEMBLING AN OTHÆMATOMA.

O. D. POMEROY, M. D., NEW YORK.

[It is thought proper to precede the report of this case by Dr. Mathewson's statement of the patient's condition previous to his coming under my care. O. D. P.]

17 CLINTON ST., BROOKLYN, June 9, 1875.

Dear Doctor, — Your note was received this morning, and I hasten to reply. Unfortunately the hospital notes of Scully's case are very meagre, so that I can give you but few dates or details.

Yours sincerely,

ARTHUR MATHEWSON.

JOHN SCULLY, æt. 42, cooper, admitted to Brooklyn Eye and Ear Hospital, May 27, 1874. He had suffered pain in right ear for two weeks, and for five days before admission there had been a discharge from this ear.

On examination the walls of the meatus were found to be red and swollen generally, and, as I recollect, the membrana tympani could not be clearly seen on account of the swelling, but there was a discharge of pus, apparently from the middle ear, so that the case was put down as one of otitis media and externa. The symptoms, *i. e.* swelling and discharge,

improved for a time, under treatment, but after a while a projecting, circumscribed prominence was noticed on the anterior wall of the meatus, half an inch within, not like a polypus, but covered with skin. This was incised, but only blood came. Afterward (I much regret the loss of dates here) the swelling extended outward, and involved the auricle, which became much thickened, and on being incised gave exit at first to a thin, serous fluid. An opening in front of the meatus and just below the tragus, afterwards formed, from which the discharge was more purulent in character. As the simple emptying of the fluid in the auricle by incisions did not seem to be of any avail, injections of argent nit. gr. v to aq. fl. ʒi. were resorted to several times, but without much effect up to the time he passed out of my hands. The case, as seen from the period of his first visit, has always seemed to me a perichondritis, set up at first by the inflammation of the middle ear, and extending outward along the cartilage of the meatus till the auricle was involved.

John Scully, aged 42, in May, 1874, experienced a violent pain in the right ear, which continued with very little abatement for eleven days, when it broke, and discharged large quantities of thick, creamy pus, but affording very little relief to the pain. After a month a fleshy mass appeared in the external meatus (probably a polypus), which was removed. Subsequent to this there were circumscribed swellings in the meatus, very painful, and which were incised, giving great relief. By this time the discharge was very slight.

In July a swelling made its appearance in the region of the concha, which rapidly extended to the whole of the auricle, increasing in size by at least three times. I saw the patient for the first time on the 1st of September, when I found a large abscess occupying the region of the concha, and extending upwards, downwards, and backwards, so as to

involve about half the area of the auricle. As the engraving will show, it pointed, both in front and behind, causing the auricle to be inserted on the side of the head at about right angles. In front of the meatus, near the tragus, was a circumscribed swelling, with a fistulous opening in its apex. The large tumor appeared somewhat nodulated, resembling a carcinoma, but fluctuation was easily recognized throughout, both in front and behind, as the abscess-wall here was very thin. An incision was done posteriorly, which caused the evacuation of about five drachms of pus. The finger could be passed easily into the pus cavity, when it was found that the cartilage of the auricle had entirely disappeared from the region of the abscess; that is, the abscess cavity was bounded in front and behind by integument and connective tissue only. Subsequent to this, small abscesses made their appearance as follows: three were incised in the region of the lobules, one in the tragus, and two on the superior portion of the helix. The principal cavity closed in three weeks without special treatment A weak solution of carbolic acid was at first injected, but it augmented the discharge and produced inflammatory heat in the auricle, and was discontinued. Syringing daily with tepid water was afterwards practised. The discharge from the abscess in the helix was somewhat glairy in consistency In the engraving the site of the incision in the helix may be indistinctly seen. The patient was a little more than two months in recovering. Perhaps we might use the term "con-

ANTERIOR VIEW.

POSTERIOR VIEW.

AFTER RECOVERY.

secutive abscesses" rather than "multiple abscess" in describing this case, as at first there was only the single large abscess before described. There was no insanity, present or past, in the patient or in any of his family, that I could find. There was no injury to account for these symptoms. I am of the opinion of Dr. Mathewson, that these abscesses depended on a perichondritis developed from an inflammation of the tympanum, which involved the auricle, by extension outwards along the meatus. This case seems to me to be quite unique.

I have not yet seen or heard of an inflammation of this kind developed in this manner. The gravity of the disease is easily recognized in the greatly deformed auricle.

I am indebted to the kindness of Dr. Agnew, for the patient whose case is here recorded.

A CASE OF OTITIS MEDIA HEMORRHAGICA.

BY O. D. POMEROY, M. D., NEW YORK.

In the Transactions of this Society for 1872 appeared a report by Dr. Roosa of two cases of otitis media hemorrhagica, the name of the disease originating with the reporter of the cases. Naturally, a new disease added to our already burdened category, challenged attention, and as no member of this Society had at that time observed a similar case, it would seem proper that any additional cases which might reasonably substantiate the propositions there laid down could, with propriety, be placed on record. The following case will undoubtedly exhibit the correctness of the views expressed by Dr. Roosa: —

Mrs. S., aged 55, a washerwoman by occupation, and of English birth. She has never been troubled with ear affections until now.

On Nov. 11, 1874, was attacked at 10 P. M. with a chill, which continued all night, accompanied by a high fever and great pain in the left side of the head and correspond-

ing ear. The pain continued with considerable intensity until the sixteenth day. She states that she slept about half the nights during this time. She also had a cough dating from her first attack, and was so deaf that only loud shouts could be heard. I first saw her on the sixteenth day. The left membrana was intensely red; on its posterior portion, somewhat above, it protruded excessively, the protrusion occupying nearly the whole membrane. The other membrane was of the same color, but protruded only slightly.

The left membrane was punctured, and the meatus was nearly filled with blood, which made its appearance, mostly, after the tympanum was inflated, and which formed a clot, which appeared in the water used in syringing to be nearly an inch in length. The hearing was immediately much improved, and the pain from this time subsided. On the next day the hearing for the voice was one half; other membrane was punctured, but without evacuating more than a few drops of blood. On the eighteenth day punctured the left, and evacuated twelve or fifteen drops of blood; membrana considerably puffed out.

On the twentieth day, or nine days after the attack, the patient was found to have entirely recovered. There had been no suppuration from the first, nor any discharge from the ear. The patient had no kidney disease or known cerebral disturbance.

THE EARLY TREATMENT OF EAR DISEASES.*

BY D. B. ST. J ROOSA, M. D., NEW YORK.

I HAD intended to come to the meeting of the Society somewhat prepared to discuss this question of the early treatment of acute aural disease: but after looking over my

*The remarks of Dr. Roosa refer to a paper by Dr C. R. Agnew, on "Five hundred consecutive cases of ear-disease, with remarks upon the early treatment of ear-affections," a synopsis of which the author read at the meeting. Unfortunately this paper could not be elaborated, as the author desired, on account of the press of other engagements, and consequently does not appear in this number. — ED.

statistics of those cases of chronic non-suppurative affections of the middle ear that had been under my observation and care for some seven to ten years, with a view of showing the hopelessness of attempting to completely arrest the progress of these cases, I found that more time was required for the analysis of this part of the subject than I had then at my disposal. My attention was first markedly turned to the fact that otologists have as yet paid undue attention to the treatment of chronic somewhat to the neglect of acute aural disease by a very friendly notice of my book on the ear, which said, on coming to the chapters on chronic non-suppurative affections of the middle ear, that these formed the great feature of the treatise. To my regret, on looking the matter over, I found that too much energy, as I now think, had been spent in the chapters on intractable affections, somewhat, perhaps, to the neglect of those treating of the curable diseases; and this you will find to be the case, I think, in nearly all, if not all the books on the ear that have yet been published. My experience seems to teach — in spite of all the therapeutic means that have been advised, including such operative interferences as Weber Liel's division of the tensor tympani, of which so much was hoped — that these chronic cases should be considered as analogous to cases of chronic choroiditis, of commencing atrophy of the optic nerve, and of phthisis pulmonalis. I will not say that none of these diseases are ever cured, but we are certainly very well satisfied if we arrest their progress, and we are not always able to do even this. Our mission is now at least to teach the profession and the public, that *acute* cases of aural disease are peculiarly susceptible to treatment, and that our hope for the prevention of chronic diseases lies in the early treatment of the very earliest stages of affections of the ear.

Such cases as that once mentioned to me by my distinguished friend Dr. Agnew are unfortunately too common, although not often as judiciously dealt with by the specialist as was his. A young man who had passed successfully through an acute general disease, having had at the same

time an acute suppuration of the ears, which had resulted in loss of both drum membranes, and ossicula with a granular state of the tympanic mucous membrane, and great impairment of hearing, was finally sent to Dr. Agnew for treatment, not one honest effort having been previously made to check a process that had made such fearful ravages. The doctor very properly declined to take the case at this stage and bear the odium of its result, advising the doctor who had thus neglected the only proper time for the treatment of such a case to finish what he had so successfully carried to such an advanced stage.

Through the courtesy of some of the general practitioners of New York, I am now kept busy on the afternoons of the catarrhal and exanthematous seasons in seeing cases of aural diseases at a time when they are in their very incipiency. Every one of us who has not a similar experience, must, I think, expect it, and instruct his professional brethren that those, and not the chronic ones, are the ones he especially desires to see. If we can but get the control of these cases, and get the profession rid of the idea that we are office practitioners only, the next generation will see a much less proportion of chronic cases than now falls to our lot to treat.

As to the details of treatment of which Dr. Agnew and Dr. Pomeroy have spoken, I quite agree with the former in his advocacy of leeches and paracentesis, and while I acknowledge that I have learned very much from Dr. Pomeroy in the use of nitrate of silver, I do not suppose that he meant to have us conclude that a case of pain in the ear, having its origin in the tympanic cavity or Eustachian tube, can be alleviated at once by anything short of leeches. My experience has not been quite the same as Dr. Agnew's as to the use of morphine or the other preparations of opium. So far from being able to mask the symptoms with these agents, I have never found that any doses of opium, unaccompanied by leeches or the warm douche or paracentesis, would quiet the pain, so that I place no reliance upon opium alone; and after the leeching it will not always be

needed; but experiences differ, and I will not pretend to say that there are no cases of aural disease which anodynes will not mask.

A CASE OF PURULENT INFECTION (PLEURO-PNEUMONIA) RESULTING FROM SUPPURATION IN THE MIDDLE EAR, PRESENTED WITH A SPECIMEN.

BY D. B. ST. JOHN ROOSA, M. D.

The following case does not differ materially from many that make up the literature of the transference of purulent processes from the ear to other organs of the body, to which Lebert called the attention of the profession; but it has a certain measure of completeness, in that it was observed from an early period in its history down to the *post mortem*, and is illustrated by a portion of the diseased temporal bone. It is therefore, perhaps, worthy the attention of the Society.

Wm. H., æt. 25, April 8, 1873. The patient stated that he has never heard well from the right ear, but he never had any discharge from the ear until four years before, when, after some unusual exposure to a draught of air while working on a ship in dock, he was seized with a severe pain in the ear followed by discharge of pus. Since this time he has had a discharge of pus at times from the ear, and has heard very badly on that side.

The H. D. was R $\frac{0}{40}$ $\frac{40}{40}$, pharynx tolerably healthy. The right drum-head seemed to be entirely gone, and there was considerable inspissated pus lying in the tympanic cavity. Air did not readily enter the Eustachian tubes. These notes were made at the only time I saw the patient, until I was summoned to him in consultation with Drs. Cameron and McKay of the city, more than two years after, when he was, apparently *in articulo mortis*.

Drs. Cameron and McKay have very kindly furnished me with notes of the case from the time they were consulted up

to the date just referred to. From these notes I now quote : —

"April 29, 1875. Dr. Cameron was called to see W. H., and found him complaining of intense pain in the right ear and the right side of the head. He said that he had been suffering for two weeks from this pain in the head and ear, with profuse purulent otorrhœa, and that this was accompanied by loss of appetite and sleep, with a sense of general prostration. There was no increase in the temperature of the body. These symptoms continued until May 4, when he was seen by Dr. McKay. The temperature was then 102½°. The patient stated that there had been no cessation in the intense pain in the ear and head, and that at times his sufferings had been most agonizing. There was acute pharyngitis, and a very slight amount of tenderness was experienced on pressure beneath the right external meatus and in front of the tragus on the same side. There was no tenderness over the mastoid, nor was any detected there during the subsequent course of the disease. The right ear was exquisitely sensitive to any contact, but there was a very slight discharge of pus from it. The left meatus was also somewhat injected, as also the drum-head. The watch could not be heard even when pressed upon either ear. The tuning-fork, when placed upon the forehead, was heard equally well in both ears.

"The use of leeches relieved the severe pain, but the temperature increased to 103°, and the patient complained of disagreeable feelings in his head. He was at times very irritable, and slightly delirious. For several days he remained in about the same condition. The temperature ranged from 102° to 103.5°, while the pulse varied from 70 to 85. On the 8th of May he had a chill. On the 9th, Dr. Cameron found that the patient was suffering from pleurisy of the left side. On the evening of the 9th another chill occurred. On the 10th the patient was very restless, and suffered greatly from pains in his head and chest. On the 11th, pleurisy of the right lung was also detected, with

pneumonia affecting the lower lobes of both lungs. The discharge from the ear became more abundant on the 13th, while there was copious expectoration. The head symptoms seemed to be greatly ameliorated, the mind was clear, and the general condition became more comfortable. On the night of the 18th, however, chilly sensations were again experienced, and they were followed by intense pain over the region of the lateral sinus. This pain involved the right ear, and extended down the back of the neck. There was tenderness on pressure at these points. On the 21st, after the application of leeches, the pain and tenderness were somewhat lessened; chilly sensations were experienced at various times during the past two or three days, and the temperature varied from 102° to 104 , with a slow pulse. For the first time since his illness, the tuning-fork was heard better on the right side. On the 22d, the patient had a slow, feeble, and intermittent pulse. Temperature, 104.3°, surface of the body alternately dry and moist. On the 23d, the patient complained of the right eye, that it was painful, and it soon protruded from the orbit. There was also observed a swelling upon the left side of the neck, extending down from and behind the angle of the face. On the 24th, the left eye also protruded."

On the afternoon of that day I saw the patient, and found the patient unconscious, breathing stertorously. There was a free discharge from the right ear, and the patient seemed to be blind. On the 26th, at 8 A. M., the patient died.

Autopsy, 8 hours after death. Present, Drs. Cameron, McKay, Ely, and Roosa. Marked ex-ophthalmos on both sides. Brain: General congestion of the brain substance, and very marked fulness of the vessels on the surface; no softening; no purulent collection; thrombosis of right internal jugular; pus in the right lateral sinus; excess of serous fluid in the ventricles. Thorax: There was suppurative pleuritis of the right lung; the entire surface of the lung was heavily coated with pus; there was serous and purulent effusion into the pleural sac; odor, extremely fetid.

The other organs were not examined. The temporal bone was removed in the usual manner, — the section passed through the apex of the bone in such a manner as to expose the cochlea. There was no trace of the membrana tympani nor of the ossicles. The bony wall of the lateral sinus was in a carious condition. The upper surface of the petrous bone was discolored, of a bluish tint. The cochlea and semicircular canals not examined.

I was not aware until I had the notes of the case that the left ear was so much involved during the illness as the notes show it to have been. Hence there was no examination of it after death.

EXPERIMENTS CONCERNING THE EFFECTS OF QUININE UPON THE EAR.

BY D. B. ST. JOHN ROOSA, M D.

So far as I know, although a great deal has been said in a general way, there has been very little exact experimentation or observation upon this subject. A case in which the administration of quinine was always followed by a considerable aggravation of the symptoms of otitis media has been recorded by myself.*

Dr. Hammond has also published some experiments on this subject in the *Psychological and Medico-Legal Journal*, October, 1874, p. 232, in a paper in which he gives the literature of the subject, and particularly the experience of M. Mêlier (*Expériences et Observations sur les Propriétés Toxiques du Sulfate de Quinine. Mémoires de l' Académie Royale de Médécine, etc. p. 722.*) Mêlier is very decided as to quinine causing deafness, as are other writers; but observations as to the immediate effect of the drug upon the membrana tympani or other parts of the ear do not appear except in the account of Dr. Hammond's own case.

---

* Treatise on the Ear.

Having myself administered the quinine to Dr. Hammond on that occasion, and noted the results which were published, I was led to repeat the experiment in some other cases. The results of these experiments I now bring to the attention of the Society; and as the report had no very wide circulation, and may have escaped the attention of the Society, I may first quote the experiment upon Dr. Hammond, which was made on the evening of May 7, 1874. The optic papillæ and the membranæ tympanorum were the parts examined, as well as the ocular conjunctivæ and auricles. "The vision was normal, $\frac{20}{20}$. Refraction, emmetropic: pulse, 90; ocular conjunctivæ, white, decidedly free from hyperæmia; palpebræ, congested at outer and inner canthus. There was no tinnitus aurium. Membranæ tympanorum were entirely free from evidence of blood-vessels. (I will omit the details of the examination of the optic papillæ, since we are concerned only with the effect of quinine upon the auditory apparatus.)

Dr. Hammond took gr. x. of sulphate of quinine at 8.30 P. M. At 9 P. M. the ocular conjunctivæ were congested at the outer and inner canthus; palpebræ conjunctivæ were markedly congested over the whole surface. There was no change in appearance of the drum-heads.

"10 P. M. Head feels full; left ear rings; auricles burn: face is decidedly flushed; auricles are red, especially the lobe of right, where there is a localized congestion, so marked as to resemble an ecchymosis. There is now a vessel along each malleus. The optic papillæ are pinkish from apparent enlargement of lateral vessels.

"10½ P. M. Right drum-head is very much injected along the handle of the malleus and the upper margin; left is less red, but still shows vascular injection. Both papillæ are pink, left more so than right; face flushed, eyes suffused, ocular conjunctivæ decidedly congested, slight headache, tinnitus in both ears."

"11 P. M. The redness of the auricles is diminishing, especially the circumscribed spot on the lobe of the left one;

the face still flushed; tinnitus continues; no headache; subject feels exhilarated; drum-heads still injected along the malleus. . . . Tinnitus still continues; vision normal."

It should be said that Dr. Hammond, the subject of these experiments, is a very large and well-developed man, and that he smoked a mild cigar during the evening.

On the 28th May, 1875, I repeated the experiment upon Dr. E. T. E., æt. 24, a man of about five feet six inches in height, well developed, in good health and vigor. He stated that he never had had otitis. The hearing distance is $\frac{40}{40}$ on each side; refraction, emmetropic. He has no tinnitus aurium. The drum-heads are free from vessels, and normal in appearance; optic papillæ normal. At 11 05 A. M. Dr. E. takes gr. x of sulphate of quinine. At 11.35 there is a very fine vessel along the right malleus; no change in the left. At 12.30 there is some redness at the periphery of the left drum-head, but the vessel on the right has disappeared. At 1 P. M. the redness has disappeared from both sides. No change is observed in the optic papillæ. There is no tinnitus, and no sense of exhilaration. No tobacco or other stimulant was used during the time of observation.

June 23, 1875. — Dr. C., æt. 25, about five feet nine inches in height, rather spare. Refraction myopic, $\frac{1}{12}$ v. $= \frac{20}{20}$. Drum-heads absolutely free from congestion. No vessel on or along malleus. Optic papillæ are both flushed.

At 10.16 A. M. takes 15 gr. of sulphate of quinine. 11 A. M., a vessel is seen along malleus of right membrana tympani; and left membrana tympani presents no change. There is slight vertigo. 11.30. There is a sense of heat and tingling over the whole surface of the body. Sense of fulness in ears and head. The handles of both mallei are injected. The hands are tremulous, and the subject gives general evidence of nervous excitement. There are sounds of a high note in the ears. The ears feel warm. At 12.30 the injection of the malleus is disappearing, as are the vertigo and tremor. At 12.50 the mallei are still injected.

Motions of the jaw cause peculiar and unpleasant sense of vibration in the ears.

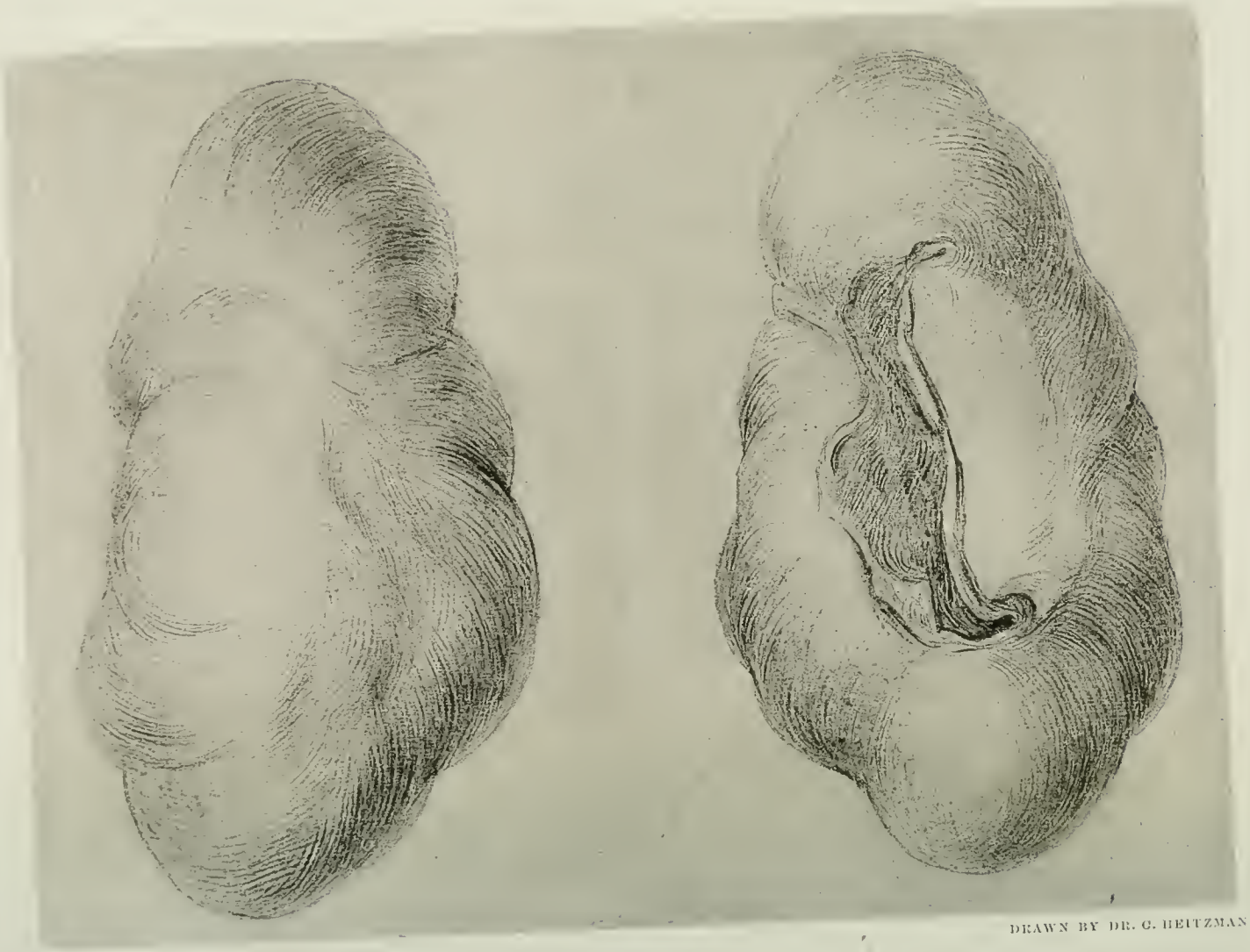
Although these experiments are but three in number, they are sufficient, I think, to justify the view I expressed at the time of publishing a paper upon the "Diseases of the Internal Ear," "American Journal of the Medical Sciences," October, 1874, — that the effects of quinine upon the ear were due to congestion. That view was contested at the time of reading the paper * by Prof. Jacobi, on the ground that some observations that had been made in Germany, as well as clinical experience, seemed to show that anæmia, and not congestion, was one of the effects of the use of quinine; that is to say, it was claimed that contraction and not dilatation of the vessels was produced by the drug. Dr. Hammond's experiments upon animals, published in the paper from which I have quoted, and what is much more conclusive than even experiments upon animals, large clinical experience, some of which is given us by such observers as the late Von Graefe, confirm the view deduced from my observations, — that the tinnitus aurium following the use of quinine is the result of overfilled blood-vessels, and is not the anæmia of blood-vessels not containing the normal quality or quantity of fluid.

It should also be stated that I have experimented upon two other physicians, giving each 10 gr. of quinine at a dose. I have no notes of these cases, but I may say that in one case congestion of the drum-heads and of the optic papillæ followed, with tinnitus aurium, while in the other *absolutely no effect was produced*. The former subject was a full-blooded man, who had suffered from congestion of the cerebral meningis. The gentleman upon whom the effect was produced had been in the habit of taking quinine, and was rather anæmic.

I am led from the discussion which followed this paper, to state that my belief is that the tinnitus aurium and impairment of hearing following the use of quinine, depend upon

* N. Y. Society of Neurology and Electrology.

congestion of the ultimate fibres of the auditory nerve in the cochlea, and that the redness of the drum-heads is merely an index of the former condition. The peripheric parts of the ear being, however, the only parts open to ocular observation, we must as yet be content with an hypothesis as to the cause of the symptoms of disturbances in the internal ear.



DRAWN BY DR. C. HEITZMAN

HELIOTYPE

MYXO-FIBROMA OF AURICLE.

TRANSACTIONS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

ELEVENTH ANNUAL MEETING.

NEWPORT, R. I., JULY 24, 1878.

Vol. 2. Part 2.

BOSTON:
HOUGHTON, OSGOOD AND COMPANY.
The Riverside Press, Cambridge.
1878.

RIVERSIDE, CAMBRIDGE:
PRINTED BY H. O. HOUGHTON AND COMPANY.

CONTENTS.

PAGE

Members of the American Otological Society 103
Minutes of the Ninth Annual Meeting (1876) 105
Minutes of the Tenth Annual Meeting (1877) 107
Minutes of the Eleventh Annual Meeting (1878) 108
Report on the Progress of Otology.
I. Anatomy and Physiology. By J. J. B. Vermyne . . . 113
II. Pathology and Therapeutics. By Samuel Sexton . . . 170
Acupuncture and Drainage in the Treatment of Serous Effusion into the Tympanic Cavity. By Clarence J. Blake 226
Coagulated Fibrin simulating Polypus of the Tympanum. By J. Orne Green 229
Complete Occlusion of the External Auditory Canal by a Dermoid Membrane; an Evidence of Horizontal Motion Outward in the Epidermis of the Canal. By Albert H. Buck 231
A Case of Myxofibroma of the Auricle. By C. R. Agnew . . . 234
The Relations of the Conducting Mechanism of the Ear to Abnormal Hearing. By Samuel Sexton 235
The Use of Ether in the Treatment of the Chronic Catarrhal and Plastic Inflammations of the Middle Ear. By George Strawbridge . 251
Salicylate of Soda as a Local Application in cases of Aspergillus Nigricans. By George Strawbridge 254
Lupus Vulgaris occurring in the Auricle. By George Strawbridge . . 255
On the Use of Sulphuric Acid as a Local Application in cases of Disease of the Bones of the Ear and the Mastoid. By Arthur Mathewson 255
Cases of Perforation of Shrapnell's Membrane, Complicated with other Aural Lesions. By H. G. Miller 257
Objective and Subjective Systolic Murmurs in the Ears. By J. Orne Green 259
A Case of Chronic Suppurative Inflammation of Middle Ear, with Epithelial Tumor extending upward into Cranial Cavity; also with Extensive Necrosis of the Mastoid and other Portions of Temporal Bone, without External Swelling. By Arthur Mathewson . . 270
Aural Inflammations with Exanthemata. By H. N. Spencer . . . 273
Zaufal's Specula. By J. S. Prout 275

MEMBERS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

HONORARY MEMBERS.

Prof. Alfred M. Mayer	Hoboken, N. J.
Prof. Ogden N. Rood	New York, N. Y.

MEMBERS.

Dr. Frank W. Abbott	Buffalo, N. Y.
Dr. Cornelius R. Agnew	New York, N. Y.
Dr. Edwin W. Bartlett	Milwaukee, Wis.
Dr. Robert M. Bertolet	Philadelphia, Pa.
Dr. Clarence J. Blake	Boston, Mass.
Dr. Albert H. Buck	New York, N. Y.
Dr. Charles H. Burnett	Philadelphia, Pa.
Dr. John H. Dix	Boston, Mass.
Dr. Ezra Dyer	Pittsburg, Pa.
Dr. Rudolph Gebser	New York, N. Y.
Dr. John Green	St. Louis, Mo.
Dr. J. Orne Green	Boston, Mass.
Dr. Emil Grüning	New York, N. Y.
Dr. J. H. Hinton	New York, N. Y.
Dr. Edward L. Holmes	Chicago, Ill.
Dr. Samuel J. Jones	Chicago, Ill.
Dr. Charles J. Kipp	Newark, N. J.
Dr. Herman Knapp	New York, N. Y.
Dr. William S. Ludlum	New York, N. Y.
Dr. Arthur Mathewson	Brooklyn, N. Y.
Dr. C. S. Merrill	Albany, N. Y.

Dr. Horace G. Miller	Providence, R. I.
Dr. Henry D. Noyes	New York, N. Y.
Dr. J. F. Noyes	Detroit, Mich.
Dr. Charles I. Pardee	New York, N. Y.
Dr. Howard Pinkney	New York, N. Y.
Dr. Oren D. Pomeroy	New York, N. Y.
Dr. Thomas R. Pooley	New York, N. Y.
Dr. J. S. Prout	Brooklyn, N. Y.
Dr. William Rankin	Newark, N. J.
Dr. Charles E. Rider	Rochester, N. Y.
Dr. C. A. Robertson	Albany, N. Y.
Dr. D. B. St. John Roosa	New York, N. Y.
Dr. John D. Rushmore	Brooklyn, N. Y.
Dr. William W. Seely	Cincinnati, O.
Dr. Samuel Sexton	New York, N. Y.
Dr. Henry L. Shaw	Boston, Mass.
Dr. Francis Simrock	New York, N. Y.
Dr. Nelson B. Sizer	Brooklyn, N. Y.
Dr. H. N. Spencer	St. Louis, Mo.
Dr. George T. Stevens	Albany, N. Y.
Dr. George Strawbridge	Philadelphia, Pa.
Dr. Charles A. Todd	St. Louis, Mo.
Dr. William Thomson	Philadelphia, Pa.
Dr. J. J. B. Vermyne	New Bedford, Mass.
Dr. David Webster	New York, N. Y.
Dr. E. Williams	Cincinnati, O.

THE AMERICAN OTOLOGICAL SOCIETY.

MINUTES FOR 1876.

New York, *September* 15, 1876.

The Ninth Annual Meeting of the Society was opened in Chickering Hall at 11½ A. M., the President, Dr. D. B. St. J. Roosa, in the chair.

Present: —

Drs. D. B. St. J. Roosa	New York.
Arthur Matthewson	Brooklyn.
David Webster	New York.
Edwin W. Bartlett	Milwaukee, Wis.
Oren D. Pomeroy	New York.
Clarence J. Blake	Boston.
J. J. B. Vermyne	New Bedford, Mass.
C. H. Burnett	Philadelphia.
Albert H. Buck	New York.
H. G. Miller	Providence, R. I.
John D. Rushmore	Brooklyn.
William Rankin	Newark, N. J.
Samuel Sexton	New York.
H. Knapp	New York.
J. S. Prout	Brooklyn.
Howard Pinkney	New York.
Samuel J. Jones	Chicago.

The chair announced, with regret, that the Secretary and Treasurer was prevented from being present at the meeting of the Society in consequence of ill-health, and, on motion, Dr. Samuel J. Jones was elected Secretary *pro tem.*

The minutes of the previous meeting were read and approved.

The Treasurer's Report was presented, and referred to Drs. Sexton and Rankin, as an auditing committee. They reported it correct, and it was then accepted.

Drs. Mathewson, Miller, and Bartlett, were appointed a committee on the nomination of officers and place of the next meeting of the Society.

The President, Dr. Roosa, declined a renomination for the office of President of the Society.

A recess of ten minutes was then taken.

The Society reconvened, and the Committee on Nominations reported names for officers.

Drs. Rankin and Pinkney were appointed tellers. On ballot the nominations of the committee were confirmed, namely: —

For President	Dr. C. J. Blake, Boston.
For Vice-President	Dr. A. H. Buck, New York.
For Secretary and Treasurer	Dr. J. O. Green, Boston.
For Committee on Publications . . .	Dr. C. J. Blake, Boston. Dr. J. O. Green, Boston. Dr. J. S. Prout, Brooklyn.

Letters were received from Dr. George B. Pomeroy, Dr. H. G. Newton, and Dr. Robert Willard, tendering their resignations as members of the Society, which were accepted.

Letters were received and read from Professors E. H. Clarke, Ogden N. Rood, and Alfred D. Mayer.

Drs. A. H. Buck and Samuel Sexton were appointed a committee to report on the Progress of Otology. Dr. Buck declined, and Dr. H. N. Spencer of St. Louis was appointed on the committee.

It was voted that the expenses of the hall and clerk, amounting to fifty-two dollars for the day, be paid by the American Otological Society alone, and not in part by the International Otological Society.

The chair then appointed as a Committee on Organization of an International Otological Congress, Drs. H. Knapp, C. J. Blake, Howard Pinkney; and the appointment of that committee was confirmed by vote.

It was then moved and carried that the Society adjourn to

meet in 1877 at the same time and place as the next meeting of the American Ophthalmological Society.

SAMUEL J. JONES, *Secretary pro tem.*

MINUTES FOR 1877.

CATARACT HOUSE, NIAGARA FALLS,
July 25, 1877.

The members of the American Otological Society, attending in conformity to the appointment for the Annual Meeting of the Society for 1877, met at the Cataract House on the twenty-fifth day of July, in the morning.

The meeting was called to order by the President, Dr. C. J. Blake, and, in the absence of the Secretary, Dr. John Green was appointed Secretary *pro tempore*.

Present: —

DRS. C. J. BLAKE	Boston.
H. D. NOYES	New York.
J. F. NOYES	Detroit.
JOHN GREEN	St. Louis.

Inasmuch as a constitutional quorum was not present, the meeting adjourned to the next day at the same hour.

July 26, 1877.

The four members named reassembled according to adjournment, and in the continued absence of a quorum and after due deliberation, unanimously agreed to recommend, —

1st. That the President call the next Annual Meeting of the Society at Newport, R. I.

2d. That the Secretary address a circular letter to the several members of the Society, inviting them to send to him such papers as they may have prepared for the Annual Meeting of 1877, and that the same be collected and published by the Secretary in the usual form and in the place of the usual annual volume of Transactions.

3d. That the Secretary assess upon the members, in the usual manner, a sufficient sum to defray the necessary expenses of the Society for the next year, including the publication as recommended.

The meeting was then adjourned *sine die*.

JOHN GREEN, *Secretary pro tem.*

The cause of the small attendance at Niagara Falls was a general strike among the railroad employés of the country, which threatened to so interfere with travel that many members were thereby deterred from leaving home.

On account of the small number of papers offered, no Transactions were published for 1877.

J. ORNE GREEN, *Secretary.*

MINUTES FOR 1878.

NEWPORT, R. I., *July* 24, 1878.

The Society met at the Aquidneck House at 10½ o'clock A. M., the President, Dr. C. J. Blake, in the chair.

Present: —

DRS. C. J. BLAKE	Boston.
O. D. POMEROY	New York.
J. J. B. VERMYNE	New Bedford.
J. S. PROUT	Brooklyn.
C. R. AGNEW	New York.
H. G. MILLER	Providence.
A. H. BUCK	New York.
GEORGE STRAWBRIDGE	Philadelphia.
ARTHUR MATHEWSON	Brooklyn.
E. W. BARTLETT	Milwaukee.
G. T. STEVENS	Albany.
S. SEXTON	New York.
D. B. ST. J. ROOSA	New York.
H. N. SPENCER	St. Louis.
F. W. ABBOTT	Buffalo.
C. S. MERRILL	Albany.

John Green	St. Louis.
J. Orne Green	Boston.

And by invitation: —

Drs. E. E. Holt	Portland, Me.
S. Weir Mitchell	Philadelphia.
W. H. Brown	Syracuse.
Lewis Fisher	New York.

The President made a few remarks calling attention to the death of Dr. E. H. Clarke, an honorary member.

The Secretary's report was read and accepted for 1876, and the report for 1877 was read, and, on motion of Dr. Agnew, was ordered to be engrossed, and the Secretary was requested to add to the report the cause of default of the meeting.

The President appointed as the Business Committee Drs. Sexton, Roosa, and Spencer, and they were also authorized to act as the Committee on Membership.

The Treasurer's report was read, and referred to Dr. Strawbridge as the Auditing Committee.

The Business Committee reported the following Order of Business: —

I. Report on the Progress of Otology.

Part I. Anatomy and Physiology. Dr. Vermyne.

Part II. Therapeutics. Dr. Sexton.

II. Use of Absorbent Cotton in Acute Inflammation of Middle Ear. Dr. Blake.

III. Coagulated Fibrin in the Tympanum. Dr. J. O. Green.

IV. A Case of Perfect Occlusion of the External Auditory Canal by a Dermoid Membrane. Dr. Buck.

V. A Case of Myxo-fibroma of the Auricle. Dr. Agnew.

VI. The Relation of the Conducting Apparatus of the Ear to Abnormal Hearing; and a New Method of Diagnosis. Dr. Sexton.

VII. Aural Contributions. Dr. Strawbridge.

VIII. Remarks on the Use of Sulphuric Acid in Cases of Chronic Suppuration of the Middle Ear with Caries. Dr. Mathewson.

IX. Cases of Perforation of Schrapnel's Membrane complicated with other Aural Lesions. Dr. Miller.

X. Systolic Murmur in the Ears, heard both subjectively and objectively. Dr. J. O. Green.

XI. A Case of Chronic Purulent Inflammation of Middle Ear with Epithelial Tumor extending into Cranial Cavity; also with extensive Mastoid Disease without External Swelling or other usual indications. Dr. Mathewson.

XII. A Contribution to the Pathology of Aural Inflammations associated with Exanthemata. By Dr. Spencer, by title.

The reading of these papers was begun and continued till 2 o'clock, when, before the eighth paper was finished, it was voted that when the Society adjourn it meet again at 7 o'clock. Notice was given of a proposed amendment to the By-laws by Dr. Blake.

At 2.10 P. M. the Society adjourned.

Second Session.

The Society was called to order at 7.45 o'clock, P. M., Dr. Buck in the chair a short time, in the temporary absence of the President. The minutes of the first session were read and approved.

The reading of the papers was then concluded. After reading each paper was referred to the Publishing Committee. Oral communications were then made by —

Dr. Roosa on a medico-legal case.

Dr. Blake on a middle-ear syringe.

Dr. Sexton on an aural instrument case.

Dr. Prout on Zaufal's nasal specula, with demonstrations on himself.

Dr. J. Green on a valve action in the Eustachian tube.

The proposed amendment to the By-laws was then considered, and after discussion the following was adopted in the place of sections 1 and 2 of the By-laws:

SEC. I. There shall be a Committee on Membership, consisting of three (3), to whom all nominations shall be referred,

and who may report on each name as they shall think proper, such report to be made at the next Annual Meeting following that at which the nomination is made; but the proposers of any name may, after the report of this committee has been received, bring such name before the Society.

SEC. II. A candidate must be nominated in writing, in open meeting, by two members of the Society, such nomination to be referred to the Committee on Membership, and to stand over for one year as hereinafter provided.

Soon after the nomination the Secretary shall send the name of the candidate, with the names of his proposers, and of the Committee on Membership, to every member of the Society. Ten days before the date of the meeting at which the report of the Committee on Membership is to be presented the candidate shall send to the Secretary of the Society a paper on some subject connected with Otology, which shall be read at the meeting.

The following nominations were then made: —

DR. EDWARD T. ELY, of New York,
By Drs. Roosa and Prout.

DR. U. H. BROWN, of Syracuse, N. Y.,
By Drs. Pomeroy and Agnew.

DR. WILLIAM H. CARMALL, of New Haven, Conn.,
By Drs. Pomeroy and Sexton.

DR. E. E. HOLT, of Portland, Me.,
By Drs. Blake and Green.

DR. LUCIEN HOWE, of Buffalo, N. Y.,
By Drs. Prout and Merrill.

The Business Committee reported the following list of officers of the Society, and on ballot they were elected: —

President	DR. A. H. BUCK,
Vice-President	DR. C. H. BURNETT,
Secretary and Treasurer	DR. J. O. GREEN.
Committee on the Progress of Otology . .	DR. J. J. B. VERMYNE, DR. DAVID WEBSTER.
Committee on Publications, ...	DR. C. J. BLAKE, DR. J. S. PROUT, DR. J. O. GREEN.

The President appointed the following as the Committee on Membership : —

Drs. Blake, Mathewson, Strawbridge.

And they were confirmed by the Society.

At 10.30 P. M. the Society adjourned.

J. ORNE GREEN, *Secretary.*

REPORT ON THE PROGRESS OF OTOLOGY.

(*July*, 1876, *to July*, 1878.)

I.

ANATOMY AND PHYSIOLOGY.

By J. J. B. Vermyne, M. D., *of New Bedford, Mass.*

In Virchow's "Archiv.," lxxi., 1877, Schalle gives a description of a new method of examining the different parts of the naso-pharyngeal cavity and the organ of hearing *in cadavere*. It consists in removing together the complete organ of hearing, the pharynx with soft and hard palate, the naso-pharyngeal cavity in connection with the greatest part of the nasal cavity, the sphenoid sinus and the posterior half of the supra-maxillary and frontal sinus, while the anterior half of the two latter sinuses, the remaining part of the nasal cavity, and the posterior part of the mastoid process, which remain attached to the body, can be examined in situ. With proper exercise this method could be executed in a little more than twenty minutes, independently of the time needed for the special examination of the parts, and after examination the parts could easily be readjusted, so as not to show to any great extent the process which had taken place.

Loewe describes the development of the auricle in a human embryo, 1 cm. long. The three cerebral vesicles were quite distinct. The eye and its choroideal fissure could be recognized. The lens was a solid body surrounded by a pigmentary tapetum. In front of the eye lay the external processus nasalis, under this the processus maxillaris superior of the first branchial arch. The oral fissure and the united inferior maxillary processus of the first branchial arch were quite distinct. The

entrance to the organ of hearing was situated somewhat above the origin of the upper extremities. It was represented by an almost vertical fissure, looking as if it were torn, and with an anterior and posterior edge. The latter was divided in an upper and lower part by an inflexion, the future fossa navicularis. The anterior edge shows the first signs of an incisura intertragica with tragus and antitragus. The spina helicis was indicated. All the parts of the auricle were already macroscopically present before the differentiation of the foot, or that of the extremities in an upper and lower part. The remarkable configuration of the auricle depends chiefly upon inflexions in the entrance to the second branchial cleft, resp. the meatus auditorius externus.

In a paper read before the first Congress of the International Otological Society, Dr. Hunt of Boston gave the results of his investigations on the development of the ear in the pig (not of the pigeon as stated in the report of the meeting of the Congress in the "Arch. f. Ohrenh.," 1877). He has examined embryones of five different sizes. His conclusions are that the Eustachian tube is an involution of the mucous membrane of the pharynx, and in no way a remnant of a branchial fissure, as stated by Huschke and Kölliker. It lies in the tissue, in which the base of the skull is forming, and grows in length as the branchial fissures close. The external meatus is an evolution of the integument. It commences after the disappearance of the first branchial arch, as a burrow in the tissue, which composed the arch. A little projection of the second branchial arch is the first indication of the auricle. In embryones of larger size the meatus grows deeper, nearing more and more the Eustachian tube, and at last it is almost in contact with it. The portion of connective tissue between meatus and Eustachian tube, is the membrana propria of the drum, the meatus forming its dermoid or inferior surface, the Eustachian tube its superior or mucous surface. In connective tissue above and posterior to the site of the drum, the hammer and anvil have commenced forming. The stapes appears at first to be located in the vestibule, rather than in the tympanum; not free in its

cavity, for it is connected with its cartilaginous walls. It is originated from connective tissue, independently like the other ossicles, and not formed by germination from the vestibular cartilage.

Rüdinger confirms the opinion of Zuckerkandl in regard to the development of the external osseous meatus from two points of the annulus tympanicus, which can be recognized at an early period of embryonal life, as tuberculum anticum and posticum. He denies participation of the spina postica, described by Henle, in the formation of the external meatus, on the ground that it is attached to the internal lip of the plica tympanica and projects into the tympanic cavity; hence it is situated inside of the tympanum.

Urbantschitsch studied the development of the middle ear on the rabbit. According to him the middle ear is not derived from the first branchial cleft, but its formation must be sought for exclusively in the lateral divisions of the common naso-oropharyngeal cavity. These become gradually larger, but remain in communication with the oral cavity by a small fissure. The enlargement is the first indication of the middle ear, the narrow fissure, which forms the communication of the tympanic cavity with the oropharyngeal cavity is the beginning of the Eustachian tube. The integument of these different cavities is derived from the external blastodermic membrane. The tympanum is formed from a section of the lateral walls of the oropharyngeal cavity at the basis of the first branchial arch, and shows three distinct layers, outward an epiderm structure, covering the cutis, next the intermediate blastodermic layer, and inward the lining of the naso-oropharyngeal cavity. The formation of the external ear is considered entirely independent from the branchial cleft, as was already done by Hunt in the above-mentioned paper.

In another article the same author speaks about the lumen of the external meatus in the embryo and new-born. In many classes of animals the external ear, at the insertion of the auricle, is for a certain period of time entirely closed. This closure is effected in different ways by the auricle. In some

animals, as the mouse, this condition persists some days after birth; in others (rabbit) it draws itself away from the entrance of the meatus during uterine life. In the mouse, horse, cow, and cat the closure takes place by the inverted edge of the upper part of the concha uniting with the edge of the lower part. In others (rabbit, pig) the edges of the lower part are in contact with each other. In man there is no closure by epithelial structure, but there is complete apposition of the walls of the meatus. Next occurs a gradual widening at the entrance of the meatus and near the tympanum, whereby the meatus acquires a double funnel-shaped appearance, the isthmus corresponding to the place, where the cartilaginous and osseous parts of the meatus unite. Gradually the isthmus becomes wider.

Grüber states, in opposition to Reichert, that the stapes is not developed from the cartilaginous visceral layer of the second branchial arch, but from the same substance which forms the capsule of the labyrinth. In no stage of embryonic life is the fenestra ovalis present in advance of the stirrup, to connect with the latter after its development, but it is a direct result of the separation of the stapes from the substance of the labyrinth.

Gegenbaur has analyzed Vrolik's treatise on the "Ossification, and the Cranial Bones of Teleostei, with an appendix on the Ossification of the Temporal Bone in Mammals." Vrolik distinguishes three parts of the canalis Fallopiæ.

The first part, which extends to what subsequently is the hiatus, is the only one which exists in the primordial cranium of man. The second part begins at the bend at the hiatus, passes by the fenestra ovalis and extends a little way beyond the fenestra. In the primordial cranium it does not exist as a canal, but only as a depression in the external surface of the os petrosum. The cartilage at its edges assists in gradually deepening this depression, but it becomes a real canal only after ossification. The third part has no preformation as cartilage, but is formed during the ossification of the petrous bone. But in the formation of the stylo-mastoid foramen, or rather the termination of the canal, the styloid process takes a part.

In the region of the still cartilaginous pars mastoidea, almost opposite the oval window, a thin cartilaginous stem, the beginning of the second branchial arch, bends towards the cartilaginous projection, which later forms the mastoid process. Here this stem bends at right angles, and runs towards the os hyoideum. This second part of the stem forms the styloid process. The first part of the stem is connected by means of the perichondrium with the future mastoid process, and in this way forms a bridge, under which the facial nerve leaves the cranial cavity. There is, therefore, no proper foramen stylo-mastoideum in the primordial cranium on the place where it is afterwards found. The hole through which the facial nerve emerges is formed rather by a flexion of the cartilaginous branches of the os hyoideum, and the place where the facial nerve leaves the primordial cranium is the hiatus Fallopiæ. The first part of the branch of the os hyoideum remains cartilaginous for a long time; even in a skull where the entire pars petrosa was ossified, and therefore the third part of the canalis Fallopiæ was partly present, the stylo-mastoid foramen was still bounded on its anterior edge by this cartilaginous stem.

In mammals there may exist different relations. The first part is a common property of all primordial crania, the two other parts are secondary formations. In Echidna the condition, which is the temporary embryonic state in man, becomes permanent, and the canal ends at the hiatus. The second part of the canal is imperfectly formed in several mammalia (dog, cat, rabbit, rat). The third part of the canal is formed by the growth of bony tissue and with the assistance of the cartilaginous cornu of the os hyoideum. In the beaver, marmot, and guinea pig, the canal shows the same three sections as in man.

From the above Gegenbaur draws the following conclusions: The external opening, through which the facial nerve emerges in the lower vertebrata is analogous to the place, where subsequently the hiatus appears in mammals. In the lower vertebrata the branches, issued by the facial nerve beyond this spot, must be looked for outside of the cranium. The enclosure of

the stapedius muscle by the petrous bone must be considered as a secondary process, connected with the formation of the lower part of the canalis Fallopiæ.

Rüdinger represents the canal at first as a relatively wide, shallow furrow on the medial wall of the tympanic cavity, which by elevation of its edges gradually deepens. In this manner there is formed on the anterior superior surface of the pars petrosa, a bony ridge, which forms at the same time a covering around the knee of the facial nerve so that immediately under the hiatus the canal is formed first. In the dog, horse, deer, and cat, there is no complete canalis facialis, but it remains in a condition of lower development, corresponding with some of the embryonic conditions in man.

It may be proper to refer at this place to Politzer's investigations of the styloid process, in Blake's "Report on the Progress of Otology," 1875, page 14.

Moldenhauer represents the formation of the canalis facialis mostly as Rüdinger, that of the styloid process as Politzer. He makes the observation, however, "that this judicious observer seems to have overlooked one point, namely, that the styloid process, in an early stage of development, is connected on its upper part by a cartilaginous process, one half centimeter long, with the cartilage, from which later the pars mastoidea is formed. This cartilaginous connection is still visible, when the adjacent parts are entirely ossified, and only disappears with the complete ossification of the styloid process itself."

The same author has examined the condition of the tympanic cavity in the fœtus and new-born infants in regard to the gelatinous mass, which fills the cavity, and its value in forensic medicine. His conclusions in the latter respect differ from those of Wreden and Wendt. In the first half of uterine life the tympanic cavity is seemingly filled with a gelatinous substance. Microscopically, however, a small cavity, lined with epithelium, can be discerned near the tympanum. This substance changes to a loose connective tissue, which is completed about the seventh month. But on account of the excessive physiological swelling and hyperæmia the two mucous sur-

faces lie so closely together, that a free lumen of the cavity cannot be spoken of. As a rule this is only formed after birth, when beginning respiration forces the blood from the tympanic cavity into the newly opened channel of pulmonary circulation, and the space thus formed is filled with air. Exceptionally this embryonic condition of the mucous membrane may persist during a few days of extra-uterine life. He thinks this condition of permanency to be due to a deficient energy of respiration, and that under favorable circumstances this hyperæmia may result in exudation and suppuration. The presence of this mass does, therefore, not exclude intra or extra-uterine respiration, the more as sometimes the swelling diminishes during intra-uterine life, when liquor amnii can penetrate within the cavity.

Another communication on the same subject is from Schmaltz. His opinion is essentially the same as that of the preceding author. He believes, however, that the process which produces the disappearance of the gelatinous mass is one of retrogressive metamorphosis beginning already before birth, and after this, assisted by all concomitant conditions, which bring the muscles of the tubes into action and thereby produce ventilation of the middle ear.

Defective development of the organ of hearing is the subject of the following papers: —

O. Israel describes a case of dignathia, or double inferior maxilla, where also the left side showed a double tragus.

A communication by Urbantschisch on fistula auris congen ita shows that this defect was found by him twelve times in 2,000 cases. Of these twelve cases, the fistula was blind in nine, either dry or secreting a milk-white fluid. In three cases there were shallow depressions, resembling the pitting of small-pox, which he considers as resulting from fistula. He gives a short history of a case where fistula congenita at the right side could be ascribed to hereditary predisposition. As neither by probe, nor by injection, any communication could be proved with the ear, he doubts that there exists any connection, which moreover would be impossible, according to his theory of development of the external ear.

Atresia auricularis externa is the subject of an article by Bremer of Copenhague. The history is given of four cases, hitherto unpublished, two of which were observed by Meier in Copenhague, one by himself and one by Prahl in Slagelse. In the first of Meier's cases the left auricle of a young girl was so deformed, that its constituent parts could not be recognized. There was no porous acusticus, but behind the auricle there was a place, which receded on pressure with a probe. The entire left half of the face was less developed and the zygomatic arc less prominent. In the second case, that of a little boy, the right ear showed deformity and was smaller than the left. Parts, corresponding to tragus, antitragus, and anthelix, could be partly distinguished. Between these points was a small triangular depression, at the bottom of which the porus acusticus was supposed to be. Bremer's case concerns a boy of thirteen in whom both ears are equally affected. The auricle shows a little stump, containing in its upper part an irregular cartilage; the lower part has imperfectly the form of the lobule. The greater part of the facial bones is but little developed; the infra-orbital region very deep; the infra-orbital margin wanting; the zygomatic arc very short and the zygomatic process of the temporal bone entirely absent. A narrow slit separates the ramus of the lower jaw from the pars mastoidea; the pars tympanalis of the temporal bone does therefore not exist. Prahl's case, in a boy of five, where the right ear only was imperfectly developed, showed an appearance very much like that of Bremer's case.

In the "Report on the Progress of Otology" for 1873 by Burnett, appears an analysis of a paper by Zuckerkandl on the development of the external meatus auditorius, in which is stated that between the thirtieth and fortieth years the meatus may show defects in the bone which increase with age, but that defects of the meatus, which can be traced to defective development of the os tympanicum, belong to the greatest rarities, so that among a thousand cases he only found two. Bürkner has contributed a paper on the hiatus ossificationis in the external meatus, from which conclusions can be drawn, very

much different from those reached by Zuckerkandl. He examined 1,178 skulls of different age, race, and sex, and states as the result of his investigations, that this defective development is found in the anterior wall of the external meatus, most frequently in children from the second to fifth year; after this year it becomes more rare. But its persistency is far more frequent than is generally believed, it being found in adults in 19.2 per cent. of all cases. The skulls of females show the deficiency oftener than those of males, and it is found with equal frequency in the anterior wall of the external meatus in adults of all races. The difference in frequency in the sexes is very striking (41.1 per cent. in the female, against 17.3 per cent. in the male). Yet Bürkner does not believe this to be accidental, rather that it assists in proving the congenital character. For in measuring the hiatus in skulls of different sexes at corresponding ages, he found almost invariably that the dimensions were larger in the female than in the male. And as naturally a larger opening will be less rapidly and less perfectly filled than a smaller one, this could explain the greater percentage of persistent hiatus in the female. He further reasons that probably the entire process of ossification of the external auditory meatus might be slower and less perfect than in the male, as analogous differences in other parts are often found.

In reporting the progress in *anatomy*, the topographical order is chosen in preference to any other. The first notice in this part is from C. H. Burnett's treatise on the ear, which appeared last year. While the original views and investigations of the author will be referred to in their place, we desire to express our great appreciation of his work, and especially of his clear and concise treatment of anatomy and physiology of the ear, giving the latest views of the best authorities. This author has made the observation, that although the external auditory canal is generally spoken of as tortuous, in the negro it is wide and straight, in fact, so much that in most cases in this race he has been able to see the membrana tympani without the aid of speculum and reflected light. He has sometimes, but rarely, seen the same kind of wide and straight audi-

tory canal in the white man. This fact leads him to the question, whether the large auricle and wide auditory canal can have any connection with the musical talent evinced by the negro race in America, as the white people where he found the same wide and straight meatus were more than ordinarily endowed with the so-called musical ear. However, at a session of the Schlesische Gesellschaft für Vaterländische Cultur, Dr. G. Joseph stated that the same wide and straight condition of the external meatus auditorius, characteristic of man in youth, is found in the Platyrrhinæ or new-world monkeys, while that of the Catarrhinæ or old-world monkeys is so long and narrow that an examination of their tympanum is hardly possible.

In the meatus of children from three weeks to one and a half year, Bürkner has six times found an independent cartilage, measuring from one to one and a half centimeter, bent on its surface. At the place where the cartilage which forms the direct continuation of the auricle ceases, the meatus is continued inward by membranous elements. It is within these, at the inferior and anterior wall of the meatus, that the cartilage is found. Its lower end has more or less the form of a hook. He found afterwards the same cartilage in connection with some larger ones, situated more outward, so as to leave a hiatus between the latter and the hook formed by the former cartilage. He believes this structure to be either a preliminary stage of the incisuræ Santorini, or an analogue to the cartilage, described by Cuvier in the meatus of long-eared animals, where it serves as a point of support for the muscles.

Moldenhauer has written a very interesting communication on comparative histology of the tympanum. The conclusions from his paper are *en resumé* the following: —

1. In no case the tympanum forms a perfect circular or oval surface. The absence of this regularity is so striking, that it may be assumed that the formation of an entirely regular circular or oval surface was not in the plans of nature.

2. Even in contiguous families the size of the tympanum shows absolutely and relatively the greatest differences. In

general it may be said that the size of the tympanum is in inverse ratio to that of the animal.

3. The curvature of the tympanic surface differs in different classes of animals, and three forms may be distinguished : —

a. The tympanum forms an even surface, or at least approaches to it (turtle, frog).

b. The surface of the tympanum is curved outward, either slightly (lizard), or stronger (birds). Its centre forms a prominence (cupola), and the meridians drawn from the top of this cupola to the periphery form concave lines.

c. The surface of the tympanum is more or less curved inward, forming, as it were, a funnel, opening in the meatus (umbo), and the meridians drawn from the bottom of this depression to the periphery are convex lines. This condition is found in man, and, as far as known, in other mammals.

In *b* and *c*, the top of both outward and inward curve lies generally eccentric.

4. As the tympanum presents an even surface, or a cupola in animals which are provided with a columella, but an umbo in such animals as possess a hammer, a certain relation between this form of the tympanum and the form of the ossicles of hearing must be assumed to exist.

5. With the change of curvature of the tympanum, its mechanism also changes.

6. As was the case with the curvature, we find entirely different conditions in regard to the inclination of the tympanum in different classes of animals. In birds this inclination is about the same as that in man and mammals. In the lizard, the tympani would intersect posteriorly; in the turtle they run almost parallel; in the frogs the planes of the tympanum would intersect above.

7. The thickness of the tympanum shows great varieties in different classes, and the difference in thickness in separate zones of the same tympanum is characteristic. The thickness of the intermediate zone is the largest in the turtle, measuring 0.5 mm., the same in man is 0.1 mm., in the frog 0.07 to 0.08 mm., in the goose and the lizard, 0.03 mm.

8. The elastic extensibility of the tympanum must be considered as a rule as very small. This shows especially in the tympanum of birds and lizards.

9. In all the animals examined the tympanum consists of an external and internal epithelial layer, and an intermediate layer of connective tissue. The latter shows great modifications, and is even found to contain muscular fibres (annulus fibrosus of the frog).

10. The external epithelium consists in every case of a mucous and epiderm layer. Both are thinner than the respective layers of the adjacent parts. Either or both of these layers may contain pigment (lizard, turtle). The epithelium of birds has pigment in embryonal condition, but loses it afterward. In the bird, lizard, turtle, even in man, the deepest layer consists of longitudinal cells. Glands of the tympanum are only found in the frog. The internal epithelium is generally one layer of pavement-epithelium, which becomes thicker and more or less cylindrical, sometimes even ciliated, where it leaves the tympanum to cover the columella or the tympanic cavity.

11. An annulus fibrosus was found in all the examined animals, except the turtle, which has an annular ligament, and the frog, where it is replaced by a radiary organic muscle. In man cartilage cells are mixed in with the fibrilary connective tissue of the annulus fibrosus.

12. The membrana propria of the tympanum is formed from the annulus fibrosus. In all cases the membrana propria consists of fibrous tissue, except in the turtle, where it is formed by a disk-shaped extension of the cartilaginous columella.

13. While in man the radiary and circular layer are distinctly present, the circular layer of the bird is formed by bundles of fibres, which, beginning from different parts of the periphery curve like arches, and terminate again in the periphery. In the frog and the lizard there are within the membrana propria bundles of fibres crossing each other, but no distinct layers.

14. The membrana propria is covered on its outer and inner

surface with loose connective tissue, which becomes more dense in the vicinity of the epithelial layers. In the lizard, turtle, and frog, these layers of connective tissue contain pigment cells. In the lizard there is also found an analogue to the dentiform structure in man.

15. The manubrium mallei in man is formed for the greatest part by endochondral ossification. Remnants of the primordial cartilage remain during all periods of life. These remaining cartilaginous layers are covered externally by a thin bone lamina from the periosteum.

16. The sickle-form of the manubrium is dependent upon the presence of the largest amount of material at the place most favorable for the greatest expenditure of force of the bone.

The investigations of Burnett on the blood-vessels of the tympanum, the peculiar arrangements of vascular loops, and the peculiar distribution of blood-vessels in the membrana tympani of man, of the dog, cat, goat, and rabbit, and of the guinea pig, have already found notice in the report for 1873. In regard to the existence of the foramen Rivini, he ranges himself at the side of Hyrtl, who denied the existence of a normal opening in the membrana flaccida; he does not understand how it could be possible that an opening should be so small that it should require diligent search for hours with a magnifying glass to find it, yet, when found, large enough to pass a bristle through it. He has never seen any opening in the membrana tympani that was not purely pathological, or the result of defective development. As Hunt and Urbantschitsch deny the formation of the external ear from the branchial cleft, they hold the same views as the preceding author in regard to the foramen Rivini as a remnant of this cleft.

The yellow spot seen on examination of the tympanum in the living subject at the end of the manubrium is the subject of a communication by Trautmann. Its color is exactly the same as that of the promontorium viewed through the transparent tympanum, perhaps a little more intense, yellowish-

white. In opacity of the drum it assumes a dirty gray, somewhat yellowish appearance. According to this author it does not depend upon an agglomeration of radiary fibres in a small compass (Politzer), neither upon the presence of cartilaginous tissue in the tympanum. But it is caused by the anterior edge of the manubrium in its lower third being twisted on its long axis, making an angle of forty-five degrees with the anterior segment of the drum-membrane. For the accuracy of his statement he gives the following proofs: —

1. An enlarged model, most accurately formed with the same edges and surfaces, and to which the same twist is given, shows immediately the yellow spot, when applied to an artificial membrane, under the same degree of inclination. If the anterior edge of the hammer was painted red, the spot had also a red color.

2. The same is found when the normal tympanum with hammer and anvil are carefully removed from the temporal. The yellow spot only appears when the anterior edge of the manubrium has the inclination given above, and when this edge was painted red the spot had a reddish color. But if the promontorium was painted red it did not change the color of the spot.

3. If the yellow spot is punctured with a fine needle in the living, it touches the bone immediately, and we can judge, from the depth to which the needle penetrated, that this bone could not be the promontorium. If the same was done in cadavere, it could be directly demonstrated that the point of the needle touched the lower third of the anterior surface of the handle.

From his experiments he draws the following practical conclusions of diagnostic value: —

In thickening of the epidermal layer the yellow spot will disappear sooner than the sharp edge of the manubrium.

Opacity of the tympanum without simultaneous thickening, would only change the color of the yellow spot.

In rotating the hammer on its axis, the form of the spot is changed.

If the spot does not move on inflation of air, there can be

either anchylosis in the joint between malleus and incus or the malleus may have become attached to the walls of the labyrinth. In this case the malleus will be perspectively shortened.

Ravogli, in speaking of the epithelium of the mucous layer of the tympanum, describes it as a pavement epithelium richly covered with ciliæ in rapid motion. This is in opposition to Grüber, Kessel, and Von Tröltsch. Kölliker, however, says that the mucous membrane of the tympanic cavity is replaced on the tympanum by a simple, not moving pavement epithelium, "but that this is by no means constant," and Koppen found motion in two out of fourteen cases.

At the session of the Linnæan Society, December 21, 1876, Professor Flower presented an article on the morphology of mammalian ossicula auditus by Mr. A. G. H. Doran. While treating the subject in extenso, the author more particularly confined his summary to those of the insectivora, cheiroptera, cetacea, sirenia, edentata, marsupialia, and monotremata. In the first of these groups the ossicula present no positive or marked characteristics. Among the bats there is a resemblance to what obtains in shrews, except in the genus *pteropus*, where the malleus is of a lower type. Of whales, Balaena has the most generalized type; the dolphins have relatively stout stapedial crura and other marked features. Platanista has slightly modified ossicles. Those of sirenia are distinguished by weight and outline. Certain of the edentata (armadillos) differ among themselves, and so do the sloths and ant-eaters, as far as concerns their internal ear-bones. Marsupialia possess ossicula of a low grade, still descending in the monotremata. The general conclusion arrived at, is that even by the so-to-say subsidiary differentiation of the auditory ossicles, doubtful affinities in some cases receive a certain interpretation.

The presence of formal defects in the tegmen tympani is the subject of another paper by Bürkner. These defects have been ascribed to different causes, such as inflammation, or the increased need for organic substance for ossification of the fœtus during gravidity (Hyrtl), or the increased pressure of air

in the tympanum, as by forcible blowing of the nose. This opinion is held among others by Von Tröltsch, who believes that the persistent practice of Valsalva's experiment may produce this effect. Luschka ascribes it to pressure of the corpora Pacchioni. Though admitting a possible influence of increased pressure of air in the tympanic cavity, Bürkner believes the cause to be the pressure of the brain-substance itself, upon the bony surroundings during their growth; that absorption from this pressure causes first thinning, afterwards perforation and possibly imperfect growth. This opinion is based upon the fact that of forty-four skulls, out of a total of one hundred and twenty, in which these bone defects were found, 81.8 per cent. showed very strong impressiones digitatæ and juga cerebralia. In seventy-three per cent. of these cases he found that the orbit showed exactly the same defect, while in one case it was found in the orbit alone. It is found most in the region above the head of the malleus and near the sutura petroso-squamosa, but Bürkner has found it in many other places, among others one of 3 mm. diameter opening in the fossa sigmoidea, and one of 1.5 mm. diameter in the upper wall of the carotic canal.

Rüdinger states that the septum between the M. tensor tympani and the Eustachian tube extends as a rule to the opposite side, and that therefore the name of semi-canalis is wrong. (See also Burnett, *l. c.*, p. 86.)

The controversy between Politzer and Voltolini in regard to the innervation of the M. tensor tympani, commenced in 1860, accounts of which have appeared in some of the preceding reports, is still kept up in the "Archiv" and "Monatschrift für Ohrenheilkunde." It will be remembered, that according to Politzer, the tensor tympani receives its nerve-fibres from the motor part of the fifth nerve, and that the central fibres of the n. stapedius belong to the facial nerve. Voltolini ascribes the innervation of the tensor tympani to both trigeminus and facialis. He admits that the action of the muscle is stronger by irritation of the trigeminus, less when the facial nerve, and strongest when both are stimulated, but that the

facial nerve still retained its influence after the trigeminus had lost its excitability. Politzer answers that Voltolini, contrary to all rules of such experiments, has used too strong an electric current, and has thereby induced secondary currents in other nerves.

Wildermuth, in a paper on the air-containing accessory parts of the middle ear, especially in regard to their changes at different periods of life, says that they consist of two separate parts, which are changed to a complete cellular system by the formation of numerous septa. The separation of both parts corresponds with the boundary of ossification between the pars squamosa and the pars petroso-mastoidea. They communicate not directly with the tympanic cavity, but open in the so-called aditus ad cellas mastoideas. In the adult the cellulæ petrosæ and squamosæ are separated by a septum, which in some cases is double, while in others there can be perforations, through which the cells communicate.

At the session of the 22d September, 1876, of the "Versammlung Deutscher Naturförscher und Aertzte," at Hamburg, Hartmann exhibited three cases out of one hundred examined, in which there were such important anomalies in anatomical structure, that the perforation of the process in these individuals would have probably caused exposure and injury of the transverse sinus, or opening of the middle cerebral fossa.

From a number of sections on preparations of normal ears, which had been treated with perosmic acid, afterwards decalcified in dilute muriatic acid, and hardened in absolute alcohol, Politzer has found that the blood-vessels of the bony wall between the middle ear and labyrinth anastomose on one side with the blood-vessels of the labyrinth, on the other with those of the middle ear, so that the circulation of both parts is connected through the bony septum which separates them.

The tonsilla pharyngea has been made the subject of investigation by Von Teutleben. The tissue of the tonsilla which extends transversely between the tubes on the upper wall of the pharynx shows numerous projections and depressions, between which are found the openings of mucous glands. It is

most distinct in the child, but very much reduced in the adult, so that no more projections can be seen, and only with magnifying power small depressions, the size of a pin-head. The projections and depressions are filled or surrounded by adenoid tissue, the arrangement of which can show different modifications in the adult. The epithelium of the surface enters the depressions, some of which resemble the follicles described by Gerlach in the tube of children. These conclusions, different from those of Luschka and Wendt, are explained by Trautmann, from the fact that hyperplasia of the tonsilla pharyngea occurs more frequently in children than in adults, while retrogressive metamorphosis (atrophy and fatty degeneration) only appear in the adult, especially after thirty, and never in children. Teutleben's description, therefore, is not that of the normal pharyngeal tonsilla.

Voltolini, in speaking of the concha narium inferior ascribes to it, in addition to the increase of surface and the support of the erectile net, imbedded in the mucosa, also the function of a framework, which should prevent entire collapsus of the venous plexus and should provide for an extensive communication between the blood-vessels of both surfaces.

The anatomy of the internal ear has received contributions from Zuckerkandl, Rüdinger, and Weber Liel on the aquæductus vestibuli, from Horbaczewsky, Lavdowsky, Pritchard, and Coÿne on the nerve-system.

Zuckerkandl has injected the subarachnoid cavity in order to find a connection with the labyrinth, but failed. However, in incising the dura mater on the posterior surface of the petrous bone, he found a cavity, into which the injected mass had not penetrated, but which he considers as belonging to the aquæductus vestibuli. This inserts itself as a sack of connective tissue between the layers of the dura mater, descends from the bony labyrinth backward to the upper margin of the sulcus sigmoideus, where it terminates, while centrally it is continued in the vestibulum. This sack has a length of 15 mm., a width of 9 mm.; it is lined with pavement epithelium, and between its walls are extended trabeculæ of connective tissue. The

part situated within the petrous bone is called intra-temporal, that in the dura mater intra-cranial. The walls of the former are thinner than those of the latter. He then injected the aquæductus from its entrance in the pars petrosa. It extended in the form of ampullæ over the sulcus sigmoideus, and a few times the mass penetrated between the layers of the dura mater. Whether this was a natural or an artificial communication, he cannot decide. In investigating the connection between the aqueduct and the labyrinth, he found that after exposing the membranous labyrinth to view by removal of the external wall, the injected mass would burst through. The sacculus ellipticus was frequently filled, the sacculus rotundus and canales semicirculares never.

Rüdinger describes the same as a bladder-like cavity between the dura mater and the bone, from which a canal passed upward to the vestibule, where it divides in two branches which he has not been able to continue further in the adult. In a three months' fœtus he was able to trace the connection of the aqueduct with the sacculus hemi-ellipticus of the membranous labyrinth. In the membranous aqueduct he describes a connective tissue, which may be considered as the periosteum of the bony canal, and is connected with the same tissue of the Haversian canals. Besides the aqueduct there are also found a few blood-vessels and lymph-spaces. He also confirms the investigations of Wiedersheim in regard to the extension of the aquæductus vestibuli in Phyllodactylus Europæus into a large sac, lying on either side of the cervical vertebræ. (*Vide* Burnett's "Report on Progress of Otology," 1876.)

Weber-Liel has found the same sac, communicating with the endolymphatic spaces of the labyrinth through the aquæductus vestibuli. He does not, however, consider it as a blind sac. He also thinks that the aquæductus cochleæ forms the communication between the perilymphatic spaces of the labyrinth and the arachnoid cavity. He applied a few drops of a solution of Prussian blue in the external funnel-shaped opening of the aquæductus cochleæ, and opening the superior canalis

semicircularis brought the fluid by aspiration in the perilymphatic spaces, so as to fill them completely.

Horbaczewski has written about the nerves of the labyrinth. In the sheep the n. vestibuli and n. cochleæ are completely separated from each other at their origin. The primitive fibres of the latter remain always much finer than those of the former. The size of the n. vestibuli increases with the size of the animal in a more rapid ratio than that of the n. cochleæ. In the sheep the n. cochleæ is distributed exclusively in the cochlea; the n. vestibuli in the remaining parts of the internal ear. In the horse there is an exchange of fibres. In man the two roots have a common trunk, which subsequently divides in two nerves. The n. cochleæ is not exclusively distributed in the cochlea, but gives off a fine branch, which runs in the recessus cochlearis to the vestibular extremity of the ductus cochlearis, and through the macula cribrosa to the septum of the two sacculi contained in the vestibule.

Of the greatest interest are the investigations of Lavdowsky of the final division of the acoustic nerve-apparatus in mammals. According to this author the basilar membrane consists in its entire extent of fibres, which run like strings between the labium tympanicum and the ligamentum spirale. In the habenula tecta and perforata these fibres are exceedingly thin and form but a single layer. In the zona pectinata are found two layers of fibres, separated by a homogeneous intermediate substance. The lower, tympanal layer of fibres of this zone is lined by a homogeneous tissue, upon which lies the epithelium of the tympanum. The upper or vestibular layer of fibres is divided in regular portions of about ten strings each, corresponding with the feet of the external Corti's pillars.

Corti's pillars consist of a solid substance with fibrillary texture, especially distinct at the feet. The feet of the internal pillars are intimately connected with the basilar membrane, to which they easily remain attached after removing the Corti's arches.

The supporting apparatus consists of an epithelial part, and a part formed by connective tissue. The first is formed by

the membrana reticularis, which extends inward and outward in a fine accessory net, the first of which forms the framework for the epithelia of the spiral groove, the latter for the epithelia of the zona pectinata. At the feet of the internal pillars the internal accessory net of the lamina reticularis is united with the connective tissue of the supporting apparatus, which is found in the form of an irregular frame of connective tissue fibres at the bottom of the tunnel formed by the Corti's arches. Outside of the tunnel this framework stands in connection with the supporting fibres of the external terminal cells.

To the terminal cells he adds, besides the outer and inner ciliated cells, also the acoustic granular layer at the foot of the inner ciliated cells.

In opposition to Boettcher, Lavdowsky considers the external hair-cells as twin cells, which are only perfectly separated in new-born and very young animals, but subsequently unite. The same view is held by Gottstein and Waldeyer. At the upper end of the cells is a thin, clear membrane, which lies within the meshes of the lamina reticularis, and on which are implanted the hairs, as half circular rows of rods standing closely together. The internal hair-cells are very soft, granular, with a clear, round nucleus. The number of hairs is greater than that of the external cells, and arranged in the same semicircular shape. Downward the cells pass into the granular layer. This layer is different in various classes of animals, thin in dogs and cats, thick in the calf. It consists of cells, resembling those of the granular layers of the retina.

The fibres of the n. cochlearis on emerging from the foramina of the habenula perforata drop their medullary sheath and under frequent divisions penetrate in the canalis cochlearis as extremely varicose fibres. A part of these nerves goes to the inner ciliated cells, another part runs through the granular layer and penetrates between the Corti's pillars into the tunnel of the Corti's arches. A portion of the latter fibres runs through the tunnel to the outer ciliated cells. The other portion forms a kind of plexus at the bottom of the tunnel. The nerve-fibres, which run toward the ciliated cells, connect with

these near the nucleus, and pass either into the nucleus or in the cellular substance. The lower layer of nerve-fibres shows some, which possess an S curve and pass partly through the anterior, partly through the posterior pillars of the tunnel. Their course is probably continued as spiral nerves. The Corti's membrane begins on the crista spiralis and ends behind the last row of ciliated cells, without connecting with these. It consists of thin, soft, elastic fibres with a granular intermediate substance.

"The Organ of Corti in Mammals," is the title of a communication by Urban Pritchard in the "Proceedings of the Royal Society," No. 168, 1876." He calculates the number of Corti's pillars to be 5,250 internal and 3,500 external pillars. Their substance he compares to tender hyaline cartilage, showing a tendency to break up in fibres. No nuclei could be found.

The hair-cells are described as columnar structures of granular substance with a round nucleus and flat upper end, which contains the hairs. In the cochlea of man and the monkey there are one inner and four outer rows of hair-cells; in the apex there are five rows of external hair-cells, while all other animals have but three. The lower end of the outer cells is rounded, but in man and the monkey it is pointed, giving the cell more or less a bottle-shape. This last shape is also that of the inner ciliated cells. The upper end of all cells connect with the membrana reticularis, the hairs appear free between the round meshes of the latter membrane. The granular layer is formed of cells without membrane and with round nuclei surrounded by a small quantity of protoplasm. The Hensen's supporting cells form the outer limit of Corti's organ; they constitute a kind of connecting link between the hair-cells and epithelium cells. The internal limit of the organ is formed by one or two rows of similar cells, the inner supporting cells.

The membrana reticularis forms a net, which covers the hair-cells and the pillars and is intimately connected with them. Outward the net becomes thinner and is lost finally between the epithelium cells. To the inside of the pillars there is only one row of round meshes; to the outside there

are alternating rows of round and longitudinal meshes (Boettcher's rings and Deiters' phalanges). The hairs of the ciliated cells project through the rings. Connected with the membrana reticularis are found three rows of thin trabeculæ, situated one each outside of a row of ciliated cells, which run to the basilar membrane and unite with it.

The nerves after emerging from the foramina of the habenula perforata divide in two layers, one of which terminates inside, the other outside of the Corti's arches. The nerves belonging to the first layer run through a nucleated cell and terminate in one of the inner ciliated cells. Those nerves which pass to the outside of Corti's arches subdivide again in three layers, which enter the tunnel between the pillars. The upper fibres run through the roof of the tunnel and after passing through a nucleated cell, reach the first row of outer ciliated cells. The middle fibres run through the centre of the tunnel; they enter the same nucleated cells, and send a branch downward, connecting with another nucleated cell. The lower fibres occupy the bottom of the tunnel, connect each with two nucleated cells of the inner edge of the pillar, come to the outside and there connect with the same cells, which received a descending branch from the middle layer of fibres. Another thread connects these cells with the Deiters' cells.

Steudener, who has prepared the analysis of Pritchard's communication in the "Archiv für Ohrenheilkunde" from which the preceding extract is taken, calls attention to the fact that these investigations have been made on transverse sections of decalcified bone, and in view of the difficulty accompanying such investigations he doubts the accuracy of the description of the terminal apparatus of the nerve, especially since there are no positive proofs that all these structures possess the character of nerves.

In a second communication he describes the termination of the nerves in the vestibule and semicircular canals in mammals. He distinguishes two kinds of longitudinal cells, thorn and bristle cells, limited by a cuticular membrane at their free surface.

The thorn-cells (corresponding with the spindle-shaped cells of Rüdinger) are spindle-shaped. They possess in the middle an oval nucleus, and terminate above in a fine thorn. This thorn appears on the outside through a perforation of the cuticular membrane. Downward the cell enlarges and assumes a triangular shape with a second nucleus.

The bristle cells (supporting cells of Hasse and Rüdinger) have a triangular body with oval nucleus. The base of the cell is connected with the cuticular membrane, and from this base a fine bristle passes through a corresponding opening in this membrane. The point of the cell is directed downward, becomes thicker and oval, and contains a second nucleus. The cuticular membrane is a pretty thick membrane which holds the cellular elements in position, and is perforated to let the thorns and bristles pass through. Pritchard considers this as analogous to the lamina reticularis of Corti's organ, and proposes to give it the same name. In the centre of the macula acustica the cells and their projections, the thorns and bristles are the longest; they become gradually smaller toward the periphery.

Coÿne, in a Thèse de Concours, treats the anatomy and development of the soft parts of the internal ear. In the structure of the membranous semicircular canals he describes four layers, the same as Rüdinger. The papillæ, which arise from the internal surface of the second layer, and which are considered as pathological conditions by Lucae, are always present in the adult under normal circumstances, and therefore Coÿne agrees with Rüdinger in calling them the third layer. This third layer is not found at the ampullar enlargement of the canals, neither in the utricle or the saccule. The crista and macula auditiva consist of: (1) an external layer of connective tissue; (2) a membrana propria, which is perforated on the epithelial side to give passage to nerve fibres; (3) an epithelial covering, formed by peculiar cells, which are cylindrical, nucleated, or fusiform. The layers of epithelium on the crista and macula auditiva vary in thickness in different animals. In birds they are 0.016 mm., in fishes 0.08 mm., in man about midway

between these two extremes. The epithelial cells appear to be distributed over two layers: the deeper layer is formed by nucleated cells, loosely connected with each other. In this layer terminate nerve-fibres of gangliform appearance. The upper layer presents at its surface rigid hairs, cilia, — according to Max Schultze's description, long, rigid fibres, thin at their free extremity and uniting at their deeper part with cells, of which they form a dependency.

Moos has found masses of colloid substance in the membranous labyrinth of children (as stated already in a former article) so frequently, that he now considers the occurrence of these masses in the labyrinth of children under two months of age, as an almost constant condition, and looks upon it as a transitional substance, probably the product of a metamorphosis of cells, occurring in the differentiation of tissues.

The condition of the sulci venosi of the cranial cavity, expecially with a view to disturbances in the organ of hearing, has been investigated by Rüdinger. He found that the sulci for the sinus transversi are generally unequal, the right sinus transversus being in most cases a direct continuation of the sinus longitudinalis. This difference in width and depth of the sulci transversi extends also upon the respective fossæ sigmoideæ and the foramina and fossæ jugulares. The anomaly may thus almost be considered a rule. Kasloff held the opinion that this monolateral narrowing depended upon hypertrophy of the pars petrosa, and could be considered a cause of suicidal mania. But the frequency of the anomaly, and the fact that the carotic canal is not affected, which would certainly be the case in hypertrophy, tend to disprove this opinion. The same is said by Rüdinger in regard to a case reported by Moos of aural hallucinations. The latter author believed the cause to be monolateral widening of the bulbus jugularis and the circulatory murmurs within, but Rüdinger says that considerable difference in the width of the bulbi is common, and that in the case related by Moos the usual limits were not surpassed.

Moos retorts, in the "Archives of Ophthalmology and Otol-

ogy," v., that Rüdinger has overlooked the most important link in his chain of conclusions. Not the dilatation of the bulbus venæ jugularis alone, but this in connection with a changed condition of the cerebral substance, must be considered as the cause. For according to the laws of physics a small lateral sinus or narrowing of the foramen jugulare, in connection with a wide bulbus venæ jugularis, no matter how often it occurs, must cause an eddying current in the bulb and produce a subjective impression of sound, and with the addition of an abnormal cerebral condition, must occasion auditory hallucinations.

Physiology. To the generally known case of Albinus and the one reported by Sir Astley Cooper, in regard to movement of the extrinsic muscles of the ear, Burnett, in his treatise on the ear, adds the statement, that two physicians of his acquaintance can move their auricles with ease; and that he has often seen the auricle move unconsciously in his patients, while standing behind them, and when they were obliged to be more than usually attentive. Of great interest are the results of the investigations of the functions of the auricle, contained in his two articles in "The Philadelphia Medical Times," 1873 and 1874: "The External Ear a Synthetic Resonator," and "The Resonant Functions of the External Ear," and his investigations concerning "the mechanism of the ossicles of hearing and the membrane of the round window," which having appeared in former reports, will only receive a passing notice. In speaking of the function of the auditory meatus, he says, after quoting Voltolini's opinion in regard to the removal of foreign bodies by spontaneous action of the meatus, that if a little fleck of blood on the membrana tympani or on the wall of the external auditory canal be watched for some days it will be observed to change its position by moving outward, suggestive of the growth of a nail. He believes that this outward growth of the skin of the auditory canal helps to force out the superabundant cerumen.

Grüber examined the tension of the normal human tympanum in the living and the dead, and found that the posterior

segment, and especially its superior part, recedes most on pressure with a rounded probe, the anterior superior quadrant the least. Incised wounds of equal length gape more in this part than in the posterior superior one, and when through the Eustachian tube a weak current of air is directed against the tympanum, this same posterior segment makes the greatest excursion, the anterior segment the smallest. Hence this latter has the greatest amount of tension. This does not depend upon the insertion of the manubrium, nor upon the manner of attachment of the tympanum to the meatus, for the same conditions prevail if the tympanum is separated carefully from the hammer and anvil and the tensor tympani divided.

Loewenberg studied the question, "What are the real consequences of obstruction in the Eustachian tube?" Proceeding by means of analogy, to examine what takes place in other cavities of the body, which contain atmospheric air, and especially in the lungs, he arrives at the conclusion that the opinion hitherto held of absorption of the air in the drum-cavity is erroneous, but that the process of change consists in diffusion or gaseous interchange. The physiological process occurring in the tympanum under these circumstances might be compared to that taking place in an artificially closed bronchus, as in Pflüger and Wolffberg's experiments. Thus it would consist of absorption of O. by the blood circulating in the vessels of the drum and replacement of a part of this gas by CO^2. The consequence would be a defect in the remaining sum total of gas, and this diminution would account for the sinking inward of the drumhead.

Urbantschitsch confirms the discovery of Grüber that during phonation of hck, while the head is inclined laterally, a current of air passes more freely into the tympanic cavity which is directed upward, than in the one which is downward. He explains this as depending upon different conditions of the motor apparatus of the tubes. If the head is inclined to one side, the motor apparatus of the tube, which is upward, is put more on a stretch, whereby the opening of the tubal canal is made easier and the current of air, penetrating within the

tube, finds in reality a greatly diminished resistance and can enter the tympanic cavity with almost unreduced strength. The opposite takes place in the other tube or when the head is held vertically, for there is some force needed for dilatation of the tube and this is lost for the ventilation of the tympanic cavity.

The important addition to our knowledge of the relation of the soft palate to the pharyngeal mouth of the Eustachian tube, both at rest and in motion, by Professor Lucae, has received already an extensive notice in the "Otological Report" for 1876 by Burnett and Blake. Lucae has lately added to his former observation two similar cases, only in younger patients, where a closure of the pharyngeal ostium of the tube could also be directly demonstrated during swallowing and phonation by the aid of a small speculum introduced in the naso-pharyngeal cavity through the nose. The rarity of accidents in the use of Weber's douche is, according to Lucae, another argument in favor of closure of the tube.

The function of the semicircular canals is the subject of some interesting communications. Among these we note first that of Breuer, which may be considered a continuation of his former experiments. In this new series of investigations he has made use of the centrifugal machine, and of vivisections of the semicircular canals in the pigeon, using the precaution in the latter case to produce the necessary excitation of the ampullary nerves by blowing or suction, that is, by increasing or decreasing the hydrostatic pressure within the canals. He considers the disturbance of motion in an animal operated on according to Flourens' method and the dizziness caused by continued rotatory movements as identical. In both cases a current of endolymph in a certain direction produces the sensation of a movement in another direction, exactly opposite, which calls for a compensating movement in the first direction. These compensating movements which the animal makes to recover its equilibrium may be directed by the sight, the touch, or the muscular sense for the movement of the body as a whole or by the ampullary nerves for the experience of minute move-

ments. Vivisection proves that both horizontal canals, the right frontal and left sagittal, and the left frontal and right sagittal canals, correspond with each other. If the corresponding canals were both cut, an immediate loss of the power of orientation takes place in the corresponding plane. By carefully exposing the membranous canals he could prove that if the endolymph is moved in a certain direction by blowing upon the canals, the head moves, according to the theory stated above, in a similar direction ; if the current of the endolymph is reversed, as by aspiration, the movement of the head is similarly reversed. The latter experiment, however, was not always successful. He further supposes that the auditory hairs are very inelastic, and are easily moved from their position of equilibrium by a short impulse ; if this impulse were suddenly stopped a motion in opposite direction would follow by the law of inertia. He emits another new theory, that the continued secretion of the endolymph may produce a gentle continuous current, and thereby a constant slight excitation of the ampullary nerves. This self-excitation he compares with that of the retina, and he believes that it does not disturb the equipoise as it occurs on both sides of the head at once.

Cyon publishes the following as a preliminary notice of the results of his latest experiments : —

1. The semicircular canals are peripherical organs of the sense of space, that is, the sensations produced by the excitation of the termini of the nerve in the ampullæ can serve to formulate our impressions of the three dimensions of space, the sensation from one canal corresponding to one dimension.

2. By the assistance of these sensations is formulated in our brain the representation of an ideal space, to which are related those impressions from other senses, which concern the arrangement of objects around us, and of our body among these objects.

3. The recognition of the existence of a special organ for the sense of space affords a base on which the two theories of binocular vision, the empyrical theory of Helmholtz and nativistic theory of Hering, may be reconciled.

4. The physiological excitation of the peripheric nerve of the sense of space occurs in a mechanical manner by means of the otoliths, which are found in the ampullæ. These otoliths would be set in vibration by every active or passive movement of the head, and perhaps also by the aerial waves, communicated by the tympanum to the liquid of the labyrinth.

5. The eighth pair of cranial nerves contains two entirely distinct nerves of special sense, the auditory nerve and the nerve of space (Raumnerv.)

6. The central organ of the sense of space presides over the distribution and graduation of the innervating force, which should be communicated to the muscles for the movement of the eyes, the head, and the rest of the body.

7. The disturbances manifested after a lesion of the semicircular canals are due —

(*a.*) To visual vertigo, produced by the discord between the space seen and the ideal space.

(*b.*) To the false notions engendered as to the position of the body, and —

(*c.*) To disorders in the distribution of the innervating force to the muscles.

Longhi believes that pathogenetically all kinds of vertigo are identical, hence also the simple auditory vertigo and that dependent upon injury to the semicircular canals. The vertigo depends not upon injury of the perceptive organs, nor upon that of the organs of equilibrium, but it is the expression of a generally intensified sensation or of an exceedingly strong intralabyrinthine stimulus, both of which are capable of producing alterations in the cerebellum and of consequently disturbing the muscular sense. Goltz's sense of equilibrium exists only in so far as it can be applied to the general sensibility of every part of the body ; therefore the sense of equilibrium becomes muscular sense, and vertigo a disturbance of the latter. The semicircular canals, on account of their great sensibility and of their contiguity to the cerebral centres, regulate the normal function of the muscular sense of the head, and in this way its equilibrium. When it is admitted that both acoustic

and sensible impressions of the canals can produce auditory vertigo, and that it always results from reflex, the theories of Lussanna and Goltz will agree. The auditory vertigo is therefore, according to Longhi, the experience of disarranged motion, especially of the head, or it is an involuntary, irregular movement of the entire body, but specially of the head.

In connection with this, it may be proper to refer to the notice of Bornhardt's paper, "Zur Frage über die Function der Bogengänge des Ohrlabyrinths," "Centr. Blatt.," 1875, in Blake's Report of 1875, where it is said, that the semicircular canals serve, by transmission of the vibrations, resulting from muscular contraction, to intensify the muscular sensation during action of the muscles of the head.

Gowers, in a paper in the "British Medical Journal" of March 10, 1877, on diagnosis and treatment of auditory nerve vertigo, agrees with Goltz, Mach, and Breuer, that a variation in the pressure of the endolymph, which fills the labyrinth cavity, is the cause of the phenomenon.

In cases of synostosis of the connection between the stapes and vestibule, in which patients still can hear the loud voice, Weber-Liel supposes the conduction of sound to take place through the membrane of the fenestra rotunda. This idea has also been proposed by Voltolini; but Politzer ascribes the conduction of sound in this case to the cranial bones. When imitating as accurately as possible the condition of this anomaly in a fresh corpse, the membrane of the round window could be seen to move by the aid of the microscope, and its excursions measured at about one half micrometer division, when speaking or singing; but not when the tones of different organ-pipes were conducted in the ear. He proposes to himself the question, whither the labyrinthine fluid could escape, if the stapes were unyielding, and finds its solution in his investigations, already quoted, about the communication of the aquæductus vestibuli and cochleæ with extra-labyrinthine spaces.

Exner has instituted a series of experiments to ascertain whether the cochlea serves for the perception of both tones and noises, or whether there is a special organ for the percep-

tion of the latter, as the cochlea is undoubtedly for the former. Helmholtz places the perception of noises in the nerve terminations in the vestibulum and the ampullæ. Exner objects that it could hardly be expected that a nerve fibre should be excited by feeble and aperiodical waves, while much stronger periodical waves should remain without effect, and in the second place, that Helmholtz's theory fails to explain the fact, first pointed out by Seebach, that certain noises can produce a perception of pitch, without any perceptible tone. For this reason he rejects the theory of Helmholtz and places the perception of both in the cochlea. According to his opinion the occurrence and degree of excitation of the nerve fibres depends, not only upon the elongation of the cochlear fibres, that are moved out of their condition of equilibrium ; but also upon the velocity wherewith these fibres execute their movements. In order to perceive a tone and also its pitch, whether high or low, it is necessary that at least sixteen or seventeen sound-waves arrive to the ear of the observer. Hence it would follow that the cochlea should not respond to a process, which, as for instance, an electric spark, produces only one wave. The reason why a tone is recognized only after sixteen or seventeen waves, is that only then the excursions of the cochlear fibres are sufficiently large. By means of a König's flame, Exner proved, however, that an electric spark did not produce the slightest vibration of the tympanum. The only explanation possible is that excitation of the cochlear fibres can occur without considerable elongation, provided that the vibration should take place with extraordinary velocity. In this way the probable reason why an electric spark is distinctly heard, would be that it would throw the cochlear fibres collectively into vibrations, the first of which should have the same form and extent for all of them, independent of their respective capacity of vibration, and a velocity more than twenty times greater than that of the vibrations of fibres, excited by the highest audible tones. To resume, a periodical wave produces a tone by considerable elongation of the responsive cochlear fibres, while an aperiodical wave, *i. e.*, a single wave, is able to excite all fibres,

and produce the sensation of noise, provided the impulse be sudden and strong enough to move the fibres out of their equilibrium with great velocity.

Swan M. Burnett, however, has observed a case of restricted range of audition, in which all notes above C''' (ut^4) ceased to be musical in their character and could not be distinguished one from the other, though they were still, in a certain measure, perceptible. He believes that his case appears to substantiate the theory that the perceptive auditory apparatus has two distinct functions with two separate organs for their performance, one to take cognizance of sound, as noise, the other of sound as music. The latter is of course the cochlea, and he thinks it fair to presume that in the case in question, the fibres of that part of the lamina spiralis which corresponds to the higher notes are either absent or in some manner hindered in the proper performance of their office, while that organ which presides over the perception of aerial vibrations as noise is to a greater or less extent intact. The fact that in his patient the lower notes of the piano were more brilliant in *timbre* than the higher ones, can be explained by the fact that the harmonics of the upper notes lie for a great part in that portion of the musical scale which was beyond the range of audition.

Steinhauser has furnished an interesting monograph on binaural hearing, an extract of which he has prepared for the "Archiv für Ohrenheilkunde." He says that the hearing may be designated as direct, indirect, or compound, according as the sound-waves fall upon the auricle or in the meatus directly, indirectly (after one or more reflexions), or in both ways. From the position occupied by the sound-source in space, the binaural hearing can be direct, indirect, or compound. As long as the sound-source remains within the range of direct binaural hearing, the exact location of the sound-source, and also any movement it may make, can be determined without moving the head. But if the sound-source passes beyond the range of direct binaural hearing, the location can no longer be exactly designated, and under favorable circumstances only the distance can be determined.

Within the range of direct binaural hearing the direction of the sound-source is determined by the relations of intensity, wherewith the sound is observed with either ear.

This relation depends not only upon the position of the sound-source in regard to the hearer, but also upon the angle, made by the intersection of the planes of both auricles. Hence the same sound may be differently observed by two persons, whose conditions of hearing are for the rest exactly alike. The smaller this angle, the more exact becomes the determination of the direction of a sound ; but the range of direct binaural hearing is proportionally diminished. Binaural hearing is best, when the sound comes from in front, in the visual axis ; monaural hearing is best, when the direction of the sound-source is perpendicular to the surface of the auricle. In the same person monaural hearing, the ear being turned in the direction of the sound, is better than binaural hearing, when the angle of intersection of the auricular planes is less than 60°. As this is almost the rule, it explains why attentive listeners generally turn only one ear toward the sound-source.

In normal position of the head the horizontal plane corresponding to the height of the eyes is the plane for most distinct hearing. Whenever sound is produced above or below this plane, a double movement of the head becomes necessary, one around a vertical axis, until both ears hear alike, the other around a horizontal axis, perpendicular to the direction of the sight, upward or downward, according to the sound being produced above or below the plane of most distinct binaural hearing.

In monolateral hardness of hearing the listener must take a position in regard to the direction of the sound-source, dependent on the degree of defect of hearing, so that both ears are turned toward the sound-source, the best ear, however, so much more, as the hearing of the other one is less acute.

If both ears are equally deficient in hearing, the determination of the "direction" of a sound-source is least implicated.

A sound-source is recognized as situated in the range of indirect binaural hearing, that is back of the listener, by a cer-

tain indistinctness, which characterizes all indirect sound-observation and which depends upon the fact, that these indirect observations are only a series of consecutive, more or less connected echoes, which produce an elongation of each single element of sound, in such a manner that the last echoes of one sound-element coincide with the first of its immediate successor. As hardness of hearing often prevents the exact distinction between these direct and indirect sound-impressions, persons so affected are deprived of an efficient means of localization of a sound-source.

If one ear receives the impression of direct, the other of indirect sound, it is by experience recognized that the sound-source is situated within one of the ranges of compound binaural hearing; being the right or left, according to the corresponding ear receiving the direct waves.

If the sound-source is situated either within the range of indirect, or in that of compound binaural hearing, its direction can only be determined by moving the head, so as to bring the sound-source —

1. In the direction of the best binaural hearing;
2. On the boundary between two ranges of hearing; or
3. In the direction of best monaural hearing.

Bearing on the same subject is a lecture by Lord Rayleigh, a review of which appears in "Nature." Rayleigh's experiments were made with the view of determining with what degree of certainty the direction of a sound-source could be determined. The result was that the direction of a human voice could be easily determined within a few degrees, not so well that of other sounds. A sound directly to the right or left could be determined, but for a low sound it was difficult to state whether it came from in front or from behind. If two tuning-forks were sounded, one in front, the other behind, it was impossible to decide which fork sounded, if one only was placed upon its resonator. But by making a quarter turn, so that one fork was to the right, the other to the left, the direction of the sound-source was immediately known. The possibility of distinguishing a voice from in front from a voice from

behind appears to depend upon the composite character of the sound in a manner as yet unexplained. When the sound comes in a lateral direction, the difference in intensity with which it is perceived by the two ears is very slight, which can be ascertained in a simple manner by stopping one ear and moving forwards and backwards in a circle before a sounding body.

Politzer also treats this question in a paper on Paracusis loci, being that anomaly of hearing which consists in a defective determination of the direction in which a sound proceeds. He is of the opinion that the certain determination of this direction can only be arrived at by binaural hearing. The following argument is used in favor of the position taken by him: If, while the eyes are closed, a watch is moved in a perpendicular plane from in front, over the head backward, it will be impossible to state, whether the watch is in front, above, or behind. As soon, however, as one ear is closed, the tick of the watch is heard immediately toward the side of the open ear. This occurs, even, when the eyes are open, notwithstanding the fact that the sense of vision comes to the assistance of that of hearing in determining the direction of the sound. If the watch is moved in a horizontal semicircle from in front of the head backward around a closed ear, the watch is heard at first in the direction of the open ear, but the nearer it approaches to the axis of the closed ear, the more the sensation as if the ticking came from the side of the open ear is lost, and we have in its place an indistinct observation from the closed ear, or we are unable to locate it exactly. The farther the watch is moved backward again in the semicircle, the more the sound seems to come again from the side of the open ear.

If the voice is used in the place of the watch, it will be found that, if both ears are open, while the speaker is behind the listener, the latter will be able to distinguish pretty accurately, when the former moves to the right or the left. But if one ear is closed and the speaker, at a distance of five to six meters, moves toward the side of the closed ear, the sound is often heard at the side of the open ear, but very frequently it is uncertain and only guessed at. The more the speaker comes

near the auditory axis of the open ear, the more certain becomes again the location of sound.

Urbantschitsch has experimented with different tuning-forks in order to test the conductions of sound by the cranial bones in regard to the height of tone emitted by the fork and the place of application. The tuning-forks used were a‴, gis‴, d‴, a″, g″, d″, c′, g′, corresponding respectively to 1760, 1672, 1190.4, 880, 792, 595.2, 264, and 198 v. s. The points of application were the radix nasi, the median line of the forehead, two and four centimeters above the radix nasi, the anterior and posterior half of the sutura sagittalis, protuberantia occipitalis, both tubera frontalia et parietalia, processus mastoideus, right and left, and right and left half of the occiput. The experiments were conducted on persons with normal hearing, and on patients suffering from different affections of the ear. The general result was that the perception of the vibration of tuning-forks depends not only upon the point of application, but also upon the height of the tone. With respect to the latter point it is noticeable that great differences may exist in the perception, with but slight difference in tone, so that two tuning-forks, for instance, a,‴ and gis‴, only half a tone remote, give decidedly different results. The same is to be said in regard to the point of application. For instance, a tuning-fork applied on the radix nasi may be heard only with the right ear, while the same applied only a few centimeters above in the median line of the forehead, is heard only with the left ear. If, proceeding from such a point, we gradually approach the range of perception of the other ear, a neutral region will be found where both ears perceive equally well. After this point is passed, the tone is perceived with the other ear. Hence he arrives at the conclusion that for the use of tuning-forks in diagnosis it is necessary to use different points of application, and to apply at least three forks of high, middle, and low pitch; also to make repeated examinations in the same person.

Experiments on the height and depth of the voice have been made by Dr. Löri. He found that the higher the roof of the

oral cavity and the more the nasal part of the pharynx is arched, the deeper the voice will be. Boys in the period of puberty show an increase in height of the roof of the mouth, just as a greater prominence of the pomum Adami.

The relation between hearing and speech has been popularly treated by A. Magnus. He points out that the easier or more difficult understanding of single words depends upon their being composed of more or less easily perceived sounds, and of concomitant noises, which may in some degree interfere with the distinctness of the sound. The speech of the child results purely mechanically from imitation of the sounds that are heard.

Kussmaul in "Disturbances of Speech" in Ziemssen's "Cyclopædia of the Practice of Medicine," vol. xiv., speaks quite extensively of the relation between hearing and speech. The following conclusions are drawn from numerous facts adduced: —

1. That at all events hearing cannot be called the only primary reflex source of those sounds, which we employ later in speaking in a permanent and distinctly articulate form.

2. Hearing is not an indispensable regulator of articulation. This axiom, however, must be to a certain extent modified, for it is only by the coöperation of the hearing sense that delicacy and smoothness of articulation and euphony in speech are secured.

3. The power of imitating phonetic speech is dependent on hearing and sight; but only one of these senses is really an indispensable requirement in the matter.

4. The full development of the intelligence and the acquirement of a language involving ideas are always dependent, at the very least, on the sense of touch and muscular sense.

It will be almost useless to state that these conclusions are derived from the results of education of deaf mutes.

The speaking of children, from a mere impulse of imitation, he calls an acoustic reflex. The stimulus to the motor-centre of sound originates in the acoustic centre, which receives the words as an orderly succession of sounds and transfers them to

the former. The difficult question, "Does this acoustic transfer of sounds take place behind the cerebrum or in the cerebrum?" that is, whether it is always cerebral or can be brought about through the basal ganglia below the crura cerebri, is left undecided by the author, who quotes the older experiments of Vulpian in favor of the existence of an acoustic sensorium in the posterior part of the cerebrum, and the more recent ones of Danilewsky, who holds the opinion that acoustic sound reflex can only come to pass through the medium of the cerebrum proper.

In connection with the relation of the organ of hearing to other organs of the senses and to the cerebrum, may be mentioned a very brief communication in "Nature," by Muirhead, which gives a strong noise as the occasioning cause of a sensation of color.

Dennert has written an extensive paper on the forming of combination tones. After giving the accepted views in regard to interference and beats, he quotes the two theories of Young and Helmholtz on the forming of combination tones, and although not denying the latter's theory, has tried to prove experimentally that these tones could also be the result of beats. For the production of combined sound waves he uses tuning-forks, or tuning-forks and whistles, or he whistles himself, or lets some one else whistle the necessary tone in combination with that emitted by the fork. The latter method has the advantage of immediate observation and also a variety of sounds in regard to intensity and quality. He further uses a thin elastic tube, twenty centimeters in length, with a small india-rubber balloon on one end. Two tuning-forks, tuned on c, are provided with clamps by the displacement of which the tones can be gradually raised or lowered half a tone within the octave. The elastic tube is firmly pressed in the meatus externus and both forks are applied simultaneously to the balloon with gentle pressure.

If in this manner, using both tuning-forks, c is combined with c, there are observed slow beats; both tones are distinctly heard, periodically strengthening and softening, and the com-

bined impression is that of a slowly moving wave. Every single wave can also be distinguished from its successor. The same is observed in combining c with cis, only the separate processes occur more rapidly. When c is combined with d the periodical variation of greater or less intensity of both tones is still perceived, and each combined wave can be distinguished from the next, but they are much less clear. In the combination of c and dis, if both primary tones are gently sounded the impression is received of a rapid succession of beats; but if the same primary tones are sounded more forcibly, or if the balloon is pressed more tightly, this impression of beats changes to that of a continued tone, like a deep organ tone. This character of the tone still obtains when c is combined with e and f, only there are again observed additional beats. When combining c and g a beautiful, pure, and deep tone is heard, without any admixture. That this tone is in reality a combination tone can be proved by alternately removing the tuning-forks, when it ceases at once and only the primary tone of one fork is observed, only with higher pitch. The experiment conducted in this manner could not be pushed further, as the necessary displacement of the clamps interferes too much with the vibration of the forks; for this reason a note, whistled by the investigator himself or by some one else was substituted for one fork, and c''' was used in combination with whole and half tones of the next higher octave, c^{IV} with similar tones of the next lower. The combination of c''' with c''' gives exactly the same result as in the preceding experiment. In the combination of c''' with cis''' very rapid beats could be observed, producing an impression of rapidly passing waves. If both tones are sounded forcibly, there is heard with the beats an indistinct deep tone; this is the combination tone formed by the whistled tone with the first harmonic of the tuning-fork. This tone becomes more distinct when cis''' is raised to d''', but at the same time there are again rapid beats which ultimately form a whizzing sound. If the next interval is gradually raised to e''', the tone which was heard first becomes higher, while the whizzing sound changes to a deep tone,

the combination tone formed by the whistled tone with the fundamental tone of the tuning-fork. We have, therefore, two tones in addition to the two primary ones. When c''' is combined with f''' the combination tones become higher, but in combining c''' with g''' and a''' the scale of the combination tones of the first harmonic is interrupted and only that of the fundamental tone remains. In the combination of c''' and h''' the latter is observed only when the primary tones are strongly sounded, and when c''' is combined with c^{IV} no more combination tone is heard. It must be observed that while the combination tones formed by combining c''' with d''', e''', and f''' are heard, even when the primary tones are sounded lightly; the combination of c''' with g''', a''', and h''' requires a gradually stronger sound of the primary tones for the production of combination tones.

This means, in other words, that high combination tones, such as are produced by the combination of two tones contiguous in the scale, are heard when the primary tones are lightly sounded: the farther the two primary tones are apart in the scale, the stronger they must be sounded to produce combination tones. This may explain why the scale of the combination tones of the harmonic of c''' was interrupted sooner than the scale of those of the fundamental tone.

This observation of Dennert differs from the theory of Helmholtz, which holds that two musical tones of different height should be *loudly* sounded in order to produce combination tones. Another requisite for the production of combination tones, according to Helmholtz, was the asymmetry of the tympanum and the looseness of the malleo-incudal joint. Here Dennert is also at variance with Helmholtz, for he has found that patients whose tympanum was defective or entirely wanting, could hear them also, only weaker, in proportion to the diminished acuteness of hearing. If a tuning-fork is applied to different points of the cranium in such patients, and combination tones are formed by the whistling of tones, these combination tones are observed by the defective ear. The same obtains when two tuning-forks are used for the production of

combination tones, and even when both ears are closed. If asymmetry of the tympanum and the condition of the joint were in reality necessary to the observation of combination tones, they should only be heard with the healthy ear.

In the next series of experiments c^{IV} was combined with tones from the next lower octave. If c^{IV} is combined with c^{IV} there are observed beats, now slow, now more rapid, in proportion as we succeed in sounding the two tones in unison. In combination of c^{IV} with h''' a whizzing is heard, and when the tones are loudly sounded, also a deep tone. If h''' is gradually lowered to a''' the whizzing disappears, and the tone becomes more distinct and higher, even when the whistled tone is soft. In combining c^{IV} with g''', f''', e''', and d''', there are observed combination tones in ascending scale, one tone only resulting from each combination. No combination tone is observed in combining c^{IV} with c'''.

Combination tones, according to these experiments, can result directly from beats. In making this statement, the author says that he by no means denies that they can *also* be produced according to the views of Helmholtz. To the objection that the ear should only perceive tones that correspond with simple, pendulum-like movements of the air, he answers by pointing to the simple experiments, quoted above, which show a direct change from beats to combinational tones. Again, it is by no means proved that a living organism, as the ear, should be impressed entirely like an inanimate resonator, membrane, or string, in its reaction upon the compound movements, of which the pendulum-like are only a component part. Every beat has to be regarded from a double point of view: namely, its action upon the nerve elements corresponding to the primary tones, and its capacity of producing simultaneously the impression of a tone. The first consists in a periodical change of the perceptive qualities in regard to quantity, occasioned by periodical summation and differentiation of the movements of both primary tones, and occurs at every moment, even within the beat. The second consists in a periodical movement of the contents of the organ of hearing, also occasioned by the same

periodical summation and differentiation of the movements of both primary tones, but is the result of the beats in toto. Both processes occur at the same time and independent of each other, but are not always equally observed. In this way, for instance, thirty or more beats may be produced without observation of a tone, when the primary tones are weak, but we can have immediately the impression of a tone, if we can succeed in increasing the intensity of the tones as much as necessary. Dennert believes, from his experiments and the above reasoning, that one common law governs the symptoms of interference, beats, and combination tones, which law he calls "the summation of the movements in their change to force, that is, pressure."

The observation, regarding the formation of combination tones from beats, increases the scope of the law of Ohm, in so far that the ear not only analyzes compound movements into simple ones, but also constructs simple movements out of compound ones; and that it therefore possesses the faculty both of analysis and of synthesis of a composite sound. From the other side his experiments tend to confirm the opinion of Helmholtz, that the whole mechanism of the tympanum, including the labyrinth water, must be considered as moving together. This observation on the origin of combinational tones might also serve to explain the difficult problem of simultaneous observation of different tones by one movement of the stapes, which could be formulated: "that the more rapid movements of the tympanum for higher tones take place *within* the slower movements for deeper tones."

Regarding the limits of our perception of tones experiments have been made by Preyer. For the low tones he used Appun's metallic tongues, for the higher tones König's rods and Appun's tuning-forks. He found for the lower tones, that the limit of perception lies between 14 and 24 vibrations in a second. An absolute number cannot be given on account of individual differences. With 19–20 v. s. many normal ears, and with 23–24 all normal ears hear a deep buzzing tone; with 14 v. s. it becomes indistinct, and lower than this no tone can be

observed. In his experiments for higher tones with König's rods mi (20,480 v. s.), still produced a light tone, with the tuning-forks e^{VIII} (40,960) was still audible. Up to c^{VII} (16,384 v. s.), the musical character of the tone is still distinct, and the intervals, especially the octaves, easily distinguished.

The delicacy of distinguishing the height of tones is variable and depends on practice. It is most marked between a′ and c where differences of a third of a vibration can be distinguished. In regard to the perception of intervals he found that in the middle scales with the 4th a deviation of $\frac{1}{170}$ to $\frac{1}{180}$, with the 5th $\frac{1}{800}$, with the minor 6th $\frac{1}{150}$, with the major 6th $\frac{1}{100}$, major 3d $\frac{1}{200}$, and minor 3d $\frac{1}{100}$–$\frac{1}{150}$ could be distinguished. With the octave it is $\frac{1}{2000}$ for the higher, $\frac{1}{500}$ for the lower tones. Silence is, according to Preyer, a true perception, entirely analogous to that of black by the eye.

Under the title of "Recent Acoustical Researches" A. M. Mayer publishes in "Nature," August 10, 1876, a preliminary note, on the obliteration of one sound by another. He gives as the results of his experiments: —

1. That under favorable circumstances one sensation of sound can conquer and obliterate another; and

2. That no tone, however intensive, can in the least diminish or obliterate the sensation of another simultaneous tone, which is deeper.

In regard to the value of this discovery, he says: "That the perception of a tone cannot interfere with another one of less pitch, is a remarkable physical discovery, and next to the proof of the fact, that the ear is capable of analyzing composite musical tones in their constituents or partial tones, it is probably the most important gain for our knowledge of the nature of hearing. Without doubt it will introduce important modifications in the now existing theories on the mechanism and the functions of the ear."

At the meeting of the Royal Society of May 31, 1877, Lord Rayleigh presented a communication "on the amplitude of sound waves." Starting from the principle, that a superior limit to the amplitude of waves giving an audible sound, might

be arrived at from a knowledge of the energy, which must be expended in a given time in order to generate them, and of the extent of surface, over which the waves so generated are spread at the time of hearing, he found by an ingenious experiment, that with a consumption of air, calculated at 196 cubic centimeters per second, and a pressure measured by a column of water 9½ centimeters high, a whistle, sounding f^{iv} with a frequency of about 2730 v. s., could be heard on a fine still winter day at a distance of 820 meters. From these different data he calculates the amplitude of movement of the aerial particles as less than a ten millionth of a centimeter.

The same author has an article in "Nature," November 1, 1877, page 12, on "Absolute pitch," in which he speaks of the discrepancy in the results obtained in König's scale and the numbers determined by Appun's tonometer. The tonometer consists of 65 harmonium reeds, bridging over an entire octave, so tuned that each reed gives with its immediate neighbors exactly four beats per second. It assumes that the pitch of each reed is the same, whether it be sounding with the reed above or the reed below, and the results arrived at would be vitiated by any mutual influence. He believes that the discrepancy depends in reality upon a sensible mutual action of the reeds.

Al. J. Ellis writes in the next number on the same subject, and says that the beats of the harmonium reeds in Appun's tonometer are affected by taking place in a confined space of air. Hence they are accelerated, and this acceleration, about one per cent., may account for the discrepancy.

Prof. Tyndall communicated to the Royal Society, March 21, 1878, the results of his recent experiments in fog-signals, an abstract of which appears in "Nature," April 4, 1878, p. 456. While it was almost universally believed that fog interfered with sound, in the same way as it did with light, Tyndall has proved by different experiments that permeability to sound and to light do not go together; that fog, although producing an opacity of light, does not interfere with the transmission of sound, hence cannot be said to create opacity of sound. The article further details the different means em-

ployed for the propagation of sound (among which the steam-syren receives high praise for its efficiency), and the difference of effect dependent upon the rapidity of explosion, when explosives were used.

The period covered by this report has witnessed some of the most important inventions in the dominion of sound. The members of this society are familiar with the experiments conducted by Blake and Graham Bell, while investigating the manner in which articulate sounds were produced, in which the human membrana tympani was used as a phonautograph, tracing itself on smoked glass the curves produced by different vibrations. A suggestion by Blake in regard to the means, whereby an electric current could be thrown into complex waves by communicating complex vibrations from a membrane, like the membrana tympani, to the armature of the magnet, gave the clew to the invention of an instrument which has already gained great reputation and has been put to many practical uses. We mean the *electric telephone of Graham Bell.* At a lecture delivered by Professor Bell before the Physical Society of London, December 1, 1877, an abstract of which appeared in "Nature," December 13, 1877, p. 135, he gave the history of the invention, and explained the working of his instrument. The first experiments in telephony date back as far as 1837, when Professor Page, in studying the relation of electricity to magnetism, found that if a coil of wire, transversed by a current, surrounds an iron rod, a sound like a pistol shot proceeds from this latter, whenever the current is made or broken. He was followed by De la Rive, Poggendorff, Reiss, and others. Reiss was the first one who in the experiments used the human voice. In transmitting sounds by electrical means the initial sounds themselves are in no way transmitted, but they are only employed to generate currents, which reproduce similar sounds. It is not the motion of the vocal organs themselves that is perceived in the ear, but that of air, set in motion by their means, and all peculiarities in the sound must be necessarily peculiarities in this motion. Hence, if the rapidity of motion varies, there is caused a difference of pitch,

and loudness can be regulated by changing the amplitude. The shape of the vibration produces timbre. Three classes of electric currents have been employed for transmitting sound at a distance, which may be designated as intermittent, pulsatory, or undulatory; the difference between the two latter being, that in the first the intensity of a continually passing current increases or decreases instantaneously, while in the second this variation takes place gradually, represented by a sinuous line. The first idea of the present telephone was obtained, as already stated above, in the experiments with the human membrana tympani as phonautograph. Since the very small membrane of the ear was capable of setting in motion comparatively large bones, it seemed possible that it could make a light piece of iron vibrate. In the earlier apparatus a piece of steel spring was attached to a stretched membrane of goldbeater's skin and placed in front of the pole of the magnet. It was soon found that on increasing the area of metal, the action of the instrument was improved, and this led the inventor to dispense with the membrane itself. Another branch of the investigation referred to the strength of the magnet, and this was modified by varying the strength of current. The battery was gradually reduced from fifty cells to none at all, and in the present form a permanent magnet is employed. Lastly, the effect of varying the dimension of the coil of wire was studied, when it was found that the sounds became louder as its length was diminished. A certain length was ultimately reached, beyond which no improvement was effected, and it was found necessary to inclose only one end of the magnet in the coil of wire. Vowels are transmitted easier than consonants, and as a rule those letters are best transmitted which involve a large oral aperture in their utterance. Finally, high sounds are produced more fully than low sounds.

It is not astonishing that the results, obtained by putting the instrument in practical use, should lead to different suggestions for its application in medicine. The English medical journals of the first part of this year are full of suggestions in this regard, especially with a view to auscultation, and with reference

to the latter, to class demonstration. From the different notices it appears that the instrument, so far, has not answered the expectations. More fruitful has been its application in physiological experiments (Bowditch, report on the "Progress of Physiology"); and Forbes in "Nature," February 28, 1878, p. 343, calls the telephone the most accurate test of an electric current.

Of more special importance to our specialty is a communication by Kirk Duncanson in the "British Medical Journal" of March 9, 1878, on the electric telephone as a means of testing or measuring the hearing power. By interposing a certain number of resistant coils in the conductor apparatus of a given instrument, a normal standard of hearing could be obtained. The diminishing of the resistance (number of resistant coils of fixed value) would give the hearing power of the auditory apparatus under examination.

Ackroyd calls attention to the fact, that in man the drum is inclined to the axis of the external ear passage at about an angle of 40^0. Hence he thinks that the telephone works best when spoken into in a slanting direction.

Blake, in a lecture on Sound and the Telephone, delivered before the London Society of Telegraph Engineers, says, "that the artificial tissue, which, perhaps, best represents the structure of the human membrana tympani, is found in the felting together of the fibres of some qualities of paper, and that the use of paper disks in receiving telephones, by reproducing more accurately the slighter overtones, and cutting down, as it were, the more pronounced overtones, to which special prominence is given by the metallic disk, renders the voice, though somewhat lessened in intensity, with a more natural and pleasing modulation." In the same lecture he relates his experiments with König's rods, proving that what may be called the carrying power of the current far exceeds the transmitting power of the metal disk, the character of the disk determining the limit of transmission, and with the human voice where tracings were obtained of the excursions of the disks, both of the transmitting and receiving telephones, showing a loss in motion

of 92.9 per cent., between the two telephones. Important in this connection is that the membrana tympani itself was used as a telephone.

The vibrations of the metal plate in the telephone led to the invention of Edison's phonograph or talking machine. It consists of a cylinder, mounted on a horizontal axle, capable by means of a handle of rotation and uniform lateral movement, and a metal pin or style, which is attached to a thin disk of iron, furnished with a funnel-shaped mouthpiece of vulcanite on a movable bar. A fine spiral groove runs from end to end, and a sheet of tin-foil is wrapped closely around the cylinder. When the cylinder is put in motion, the vibrations of the metal disk, caused by speaking in the mouthpiece, cause the pin to press unequally upon the cylinder, and the metal surface becomes indented to an unequal extent. In order to reproduce the sounds impressed upon the metal cylinder, it is brought back to its original position. It is then rotated again beneath the pin, which is moved up and down as the elevations and depressions pass under it. The movements of the pin are followed by the metal disk, and this throws the air in vibration, producing sounds exactly corresponding with those by which the indentations were originally produced. As the pitch of the sound is altered by varying the velocity of rotation, an exact reproduction of the voice can only be effected by causing the cylinder to revolve at the same rate as it possessed when receiving the sounds, which could be effected by clockwork. A funnel, like a speaking trumpet, is attached to the mouthpiece, to prevent dispersion of the sound.

The instrument, as yet in its infancy, cannot produce certain sounds. Yet, apart from its simple construction and really wonderful achievements, it has for us some higher importance. An editorial in the "Lancet" of March 23, 1878, p. 432, points out, from the results of the phonograph, how little seems to be absolutely necessary for the complete performance of speech. Already the utterances of ventriloquists had made it highly possible that perfect articulation can be produced without any appreciable movement of the lips or tongue. This is still

more ascertained by the results of surgery, as for instance, in the operation for removal of the tongue, by some surgical diseases, as loss of the epiglottis, and ulceration of one or even both vocal cords, when still phonation can be performed to a greater or less extent by remaining parts of the vocal organs or by an artificial reed placed in the larynx. The phonograph shows that the majority of articulated sounds are producible without aid of the peculiar resounding cavities of the mouth and nose, and some experiments conducted by Jenkin and Ewing may prove, that the theory of Helmholtz, that vowel sounds are due to the prominence of notes of absolute high pitch, is not tenable.

We gladly copy the following introduction from an editorial review on "Recent Science," in the "Nineteenth Century:" "With the invention of the phonograph, following hard upon that of the telephone, it might be fairly assumed that acoustic science had spent itself, and that it could afford for a while to lie fallow. So far, however, from this being actually the case, it continues to show abundant signs of fertility, and has indeed quite recently given birth to an instrument, which in some respects is more marvelous than either of its predecessors. Wonderful as it is to transmit articulate speech by means of the telephone, it is perhaps more wonderful to register that speech and reproduce it at will by the phonograph; but the most wonderful thing of all is this, that we should be able to magnify feeble sounds, which are absolutely inaudible by the unaided human ear, until they may be heard with almost painful intensity at the receiving station miles away. Yet this is actually accomplished though the medium of the recently invented microphone."

This instrument was discovered by Prof. D. E. Hughes. He himself calls it a discovery, not an invention. The resistance which a body offers to the passage of an electric current is invariably affected by changes of the temperature, and in some cases by variation in the intensity of light. This led Hughes to investigate whether the vibrations which constitute sound would show the same influence. For this investigation

he used a wire through which a current was passing, while a telephone was placed in the circuit to detect sound. After many attempts during which the tension of the wire was gradually increased, when this tension had reached the breaking strain, a sound became audible just at the moment of the rupture. Placing the broken ends together he found that sounds in the neighborhood of the wire were heard in the telephone, and this was every time repeated. Afterward he separated the broken ends of the wire and bridged the interval over with a metallic conductor, like a piece of a watch spring or a common nail. It was found that the more points of contact were offered, the more the intensity of the sound increased and so the number of nails was increased with increased effect. Finally Hughes employed finely divided quicksilver, absorbed in charcoal, which being highly porous, gives numerous points of metallic conduction. By means of this instrument the delicate rubbing of a feather or the walk of a fly is intensified to such a degree as to be almost painfully distinct. The mercury and charcoal is inserted in a glass tube about two inches long and a quarter of an inch in diameter.

Very soon after this discovery Dr. Richardson experimented with Professor Hughes in order to ascertain whether the apparatus can be applied to diagnostic purposes in auscultation of the lungs and the heart. The respiratory and circulatory murmurs are indeed perceived, however, not any better than through the stethoscope. There is considerable difficulty in making the sounds which are heard through the stethoscope pass in the form of electrical vibrations to the ear, and until this is achieved, the microphone is not available for the purpose of diagnosis.

Under the title of Sound Color-figures, Sedley Taylor publishes in "Nature" his experiments with the *Phoneidoscope*, a new instrument in which a thin film, like a soap-bubble, is used to make the vibrations visible. It consists of a brass cylinder in L form, having at the open end of the vertical arm a viscous soap solution. The sound vibrations are produced through a mouth-piece at the end of the short arm.

The most beautiful changes of color are produced; change of pitch causes considerable changes in the reflected figures and the complexity of colored patterns increases with the acuteness of the sound.

The interesting reports on the Progress of Otology by Dr. J. Orne Green have appeared as usual in the "Boston Medical and Surgical Journal."

Index to the Articles mentioned in the Report, arranged in Alphabetical Order of the Authors' Names.

INDEX TO PART I.

Ackroyd. — The Telephone. "Nature," Feb. 21, 1878, p. 330.

Bell, Graham. — The Telephone. Abstract of a Lecture before the Physical Society of London, December 1, 1877, in "Nature," December 13, 1877, p. 135.

Blake, C. J. — Report on the Progress of Otology, 1875. "Transac. of Amer. Otol. Society," 1875, p. 14.

Blake, C. J. — Sound and the Telephone. Read before the British Society of Telegraph Engineers, London, May 8, 1878.

Bowditch, H. P. — Recent Progress in Physiology. The Telephone as an Instrument of Research. "Boston Med. & Surg. Journ.," May 9, 1878.

Bremer, V. — Ueber Atresia Auricularis externa. "Nord. Medicin. Arkiv.," IX., 2. Refer. in "Arch. f. Ohrenh.," XIII., p. 275, by Jacoby.

Breuer, J. — Beiträge zur Lehre vom statischen Sinn, refer. in "Arch. f. Ohrenh.," XII., p. 183, by A. Eugen Fick.

Bürkner, K. — Die Ossificationsliicke im äusseren Gehörgange. "Arch. f. Ohrenh.," XIII., p. 163.

Bürkner, K. — Ein Einzelner Knorpel im kindlichen Gehörgange. "Arch. f. Ohrenh.," XIII., p. 191.

Bürkner, K. — Zur sogenannten Dehiscenz des Tegmen Tympani. "Arch. f. Ohrenh.," XIII., p. 185.

Burnett, Ch. H. — Otological Report, 1873. "Transact. of Amer. Otol. Society," 1873, p. 15.

Burnett, Ch. H. — Otological Report, 1876. "Report of the First Congress of the International Otological Society," 1876.

Burnett, Ch. H. — The Ear, its Anatomy, Physiology, and Diseases. Philadelphia, 1877.

Burnett, S. M. — Restricted Range of Audition. "Arch. of Ophthalm. and Otology," V., p. 532.

Coijne. — Anatomie et Développement des Parties Molles de l'Oreille interne. Thèse de concours, refer. in "Annales des Maladies de l'Oreille et du Larynx," II., p. 125, by Ladreit de Lacharrière.

Cyon. — Semicircular Canals. "Lancet," March 23, 1878, p. 435.

Dennert, H. — Zur Physiologie des Gehörorgans. "Arch. f. Ohrenh.," XII., p. 191.

Doran, A. G. H. — Ossicula Auditus in Mammalia. "Report of Linnean Society," Dec. 21, 1876, in "Nature," Jan. 18, 1877, p. 267.

Duncanson, J. J. Kirk. — The Electric Telephone as a Means of testing or measuring the Hearing Power. "British Med. Journ.," March 9, 1878.

Ellis, Al. J. — Absolute Pitch. "Nature," Nov. 8, 1877, p. 26.

Exner, S. — Zur Lehre von den Gehörsempfindungen. Refer. in "Arch. f. Ohrenh.," XII., p. 51, by A. Eugen Fick.

Gegenbaur. — Bemerkungen über den Canalis Fallopiæ. "Morphol. Jahrb.," II., Heft 3, p. 435. Refer. in "Centr. Blatt. f. Medic. Wissensch.," 5 May, 1877, by Loewe.

Gowers. — Diagnosis and Treatment of Auditory Nerve-vertigo. "British Med. Journ.," March 10, 1877.

Green, J. Orne. — Recent Progress in Otology. "Boston Med. and Surg. Journ.," November 16 and 23, 1876.

Green, J. Orne. — Recent Progress in Otology. "Boston Med. and Surg. Journ.," May 17 and 24, 1877.

Green, J. Orne. — Recent Progress in Otology. "Boston Med. and Surg. Journ.," November 1 and 8, 1877.

Grüber, J. — Beitrag zur Entwickelungsgeschichte des Steigbügels und ovalen Fensters. "Schenck's Embryol. Mittheil.," refer. in "Centr. Bl. d. Medic. Wissensch.," 1878, No. 3, by Loewe.

Grüber, J. — Ueber die normalen Spannungsverhältnisse des menschlichen Trommelfelles. "Monatschr. f. Ohrenh.," 5, 1877.

Hartmann. — Anomalies of Mastoid Process. Sitzungsbericht der Section für Ohrenheilkunde auf der 49ten Versammlung Deutscher Naturförscher und Aertzte zu Hamburg, 1876.

Horbaczewsky. — The Nerves of the Labyrinth. "Lancet," May 26, 1877. ("Amer. Journ. of Med. Sciences," July, 1877).

Hunt, D. — A Comparative Sketch of the Early Development of the

Ear and Eye in the Pig, together with a New Account of the Development of the Meatus Externus, Drum, and Eustachian Tube "Report of the First Congress of the International Otological Society," 1876.

Hunt, D. — On the Development of the External Ear Passages. "Amer. Journ. of Med. Sciences," Jan. 1877.

Hunt, D. — The Development of the Middle Ear. "Boston Med. and Surg. Journ.," October 18, 1877.

Israël, O. — Ein Fall von Verdoppelung der linken Unterkieferhälfte. Diss. Berlin, 1877. Refer. in "Centr. Bl. d. Med. Wissensch.," 1878, No. 1, by Grawitz.

Joseph, G. — Ueber das Verhalten des äusseren Gehörganges und der Paukenhöhle bei den Amerikanischen Affen. "Schlesische Gesellschaft für Vaterländische Cultur-Sitzung d. Naturw.," Section von 18 April, 1877.

Kussmaul. — Disturbances of Speech. Ziemssen's "Cyclopædia of the Practice of Medicine," XIV., p. 637.

Lavdowsky. — Untersuchungen über den acustischen Endapparat der Säugethiere. "Arch. f. Mikrosc. Anatomie," XIII., p. 497, refer. in "Arch. f. Ohrenh.," XII., p. 53, by Steudener.

Loewe. — Ueber die Anfänge der Ohrmuschelbildung bei einem menschlichen Embryo von 1 Ctm. Körperlänge. "Arch. f. Ohrenh.," XIII., p. 176.

Loewenberg, A. — On Gaseous Interchange in the Tympanic Cavity; Physiological Considerations and Therapeutic Applications. "Report of the First Congress of the International Otological Society," 1876, p. 117.

Longhi. — Contribution à l'Étude du Vertige Auditif. Annales des Mal. de l'Oreille, 1877. Refer. in "Arch. f. Ohrenh.," XIII., p. 289, by Kuhn.

Löri, Ed. — Zur Physiologie der Stimme. "Pester Med. Chirurg. Presse," 1877, No. 3.

Lucae, A. — Zum Mechanismus des Gaumensegels und der Tuba Eustachii. "Vortrag im Physiologischen Verein in Berlin," 5 April, 1878. Sitzungsbericht vom 5ten April, 1878.

Magnus, A. — Gehör und Sprache, Sammlung Gemeinverst. Wissensch. "Vorträge von Virchow u. Holtzendorff," XII., p. 281, refer. in "Arch. f. Ohrenh.," XIII., p. 294, by Blau.

Mayer, Alf. M. — Recent Acoustical Researches. Experimental Ob-

servations on the Obliteration of One Sound by Another. "Nature," Aug. 10, 1876, p. 318.

Mayer, Alf. M. — Edison's Talking Machine. "Nature," April 11, 1878, p. 469.

Moldenhauer, W. — Beiträge zur Anatomie und Entwickelungsgeschichte des menschlichen Gehörganges. "Arch. f. Ohrenh.," XI., p. 225.

Moldenhauer, W. — Das Verhalten der Paukenhöhle beim Foetus und Neugeborenen und die Verwendbarkeit der Ohrenprobe für die gerichtliche Medizin. "Arch. d. Heilk.," XVII., refer. in "Arch. f. Ohrenh.," XII., p. 69, by Blau.

Moldenhauer, W. — Vergleichende Histologie des Trommelfelles. "Arch. f. Ohrenh.," XIII., p. 113.

Moos, S. — The Presence of Colloid Masses in the Membranous Labyrinth of Children. "Arch. of Ophthalm. and Otology," V., p. 559.

Moos, S. — The Dilatation of the Bulbus Venæ Jugularis and its Relation to Auditory Hallucinations. "Arch. of Ophthalm. and Otology," V., p. 561.

Muirhead. — Noise the occasioning Cause of Color-sensation. "Nature," May 17, 1877.

Physiology of the Voice and the Phonograph. —"Lancet," March 23, 1878.

Politzer, A. — Zur Frage über die Innervation des M. Tensor Tympani. "Arch. f. Ohrenh.," XI., p. 159.

Politzer, A. — Ueber die Anastomosen zwischen den Gefässbezirken des Mittelohres und des Labyrinths. "Arch. f. Ohrenh.," XI., p. 237.

Politzer, A. — Studien über die Paracusis Loci. "Arch. f. Ohrenh.," XI., p. 231.

Preyer, W. — Ueber die Grenzen der Tonwahrnehmung. Preyer's "Physiol. Abhandl.," 1876. Refer. in "Cent. Blatt. f. d. Med. Wissensch.," Oct. 21, 1876, by Rosenthal.

Pritchard, U. — The Organ of Corti in Mammals. "Proceedings of the Royal Society," No. 168, 1876. Refer. in "Arch. f. Ohrenh.," XII., p. 56, by Steudener.

Pritchard, U. — The Termination of the Nerves in the Vestibule and Semicircular Canals of Mammals. "Journ. of Microscop. Science," Vol. XVI. New Ser., p. 397, refer. in "A. f. O.," XII., p. 58, by Steudener.

Ravogli, A. — Ricerche Istologiche sulla Membrana del Timpano nello stato Sano e Morboso. "Estratto dall' Archivio per le Scienze Mediche." Anno 1, fascicolo 2°, 1876.

Rayleigh, Lord. — Determination of the Direction of a Sound-source. "Nature," 1876.

Rayleigh, Lord. — Absolute Pitch. "Nature," Nov. 1, 1877, p. 12.

Rayleigh, Lord. — On the Amplitude of Sound-waves. "Report of Session of the Royal Society," May 31, 1877, in "Nature," June 7 1877, p. 114.

Recent Science (Microphone, etc.). — Editorial Review in "Nineteenth Century," No. XVI., June, 1878.

Richardson. — The Microphone in Diagnosis. "Lancet," May 25, 1878.

Rüdinger. — Beiträge zur Anatomie des Gehörorgans und der venösen Blutbahnen der Schädelhöhle. "Munchen. Literarisch-artistische Anstalt," 1876. Refer. in "Arch. f. Ohrenh.," XII., p. 60, by Moldenhauer.

Rüdinger. — Ueber den Aquaeductus Vestibuli des Menschen und des Phyllodactylus Europaens. "Zeitschr. f. Anat. u. Entwickelungsgesch.," II., p. 214. Refer. in "Arch. f. Ohrenh.," XII., p. 59, by Steudener.

Schalle. — Eine neue Sectionsmethode für die Nasen-, Rachen- und Gehörorgane. "Virchow's Archiv.," LXXI., 1877. Refer. in "Arch. f. Ohrenh.," XIII., p. 293, by Blau.

Schmaltz, H. — Das sogenannte Schleimpolster in der Paukenhöhle der Neugeborenen. "Arch. d. Heilk.," XVIII. Refer. in "Arch. f. Ohrenh.," XII., p. 299, by Blau.

Steinhauser, A. — Die Theorie des binaurealen Hörens. Wien, 1877. "Arch. f. Ohrenh.," XII., p. 62.

Taylor, Sedley. — Sound Color-figures. "Nature," March 28, 1878, p. 426.

Telegraphic and Telephonic Examination of Patients. "Med. Press and Circular," Feb. 20, 1878.

Telephone. — A. B. M., "Lancet," Feb. 9, 1878.

Telephone and Auscultation. — S. C., "Med. Times and Gazette," Feb. 2, 1878.

Telephone and Auscultation. — E. Liveing, "Med. Times and Gazette," Feb. 16, 1878.

Telephone and Auscultation. — W. Bird, "Med. Times and Gazette," Feb. 23, 1878.

Teutleben, E. von. — Die Tubentonsille des Menschen. Refer. in "Arch. f. Ohrenh.," XII., p. 160, by Trautmann.

Trautmann, F. — Der gelbe Fleck am Ende des Hammergriffs. "Arch. f. Ohrenh.," XI., p. 99.

Tyndall. — Recent Experiments in Fog Signals. Abstract in "Nature," April 4, 1878, p. 456.

Urbantschitsch, V. — Ueber die erste Anlage des Mittelohres und des Trommelfelles. Schenck's "Embryol. Mittheil." Wien, 1877. Refer. in "Arch. f. Ohrenh.," XII., p. 293, by Blau.

Urbantschitsch, V. — Das Lumen des äusseren Gehörganges bei Embryonen und Neugeborenen. Schenck's "Embryol. Mittheil," 1878. Refer in "Centr. Blatt f. d. Medic. Wissensch.," 1878, No. 3, by Loewe.

Urbantschitsch, V. — Ueber die als Fistula Auris Congenita bezeichnete Bildungs Anomalie. "Monatschr. f. Ohrenh.," 1877, No. 7.

Urbantschitsch, V. — Ueber den Einfluss der Kopfstellung auf die Intensität des in die Ohrtrompete eingeblasenen Luftstromes. "Monatschr. f. Ohrenh.," 1878, No. 6.

Urbantschitsch, V. — Ueber die von der Höhe des Stimmgabeltones und von der Applicationstelle abhängige Schalleitung durch die Kopfknochen. "Arch. f. Ohrenh.," XII., p. 207.

Voltolini. — Welches Nervenpaar innervirt den Tensor Tympani? Physiologische Untersuchungen über diese Frage. "Monatschr. f. Ohrenh.," 1876, Nos. 10, 11, and 12.

Voltolini. — Ueber eignethümliche normale und pathologische Gebilde in der Nase und die Operation der letzteren. Vortrag gehalten in der Med. Section der Schlesischen Gesellschaft für Vaterländische Cultur. Refer. in "Arch. f. Ohrenh.," XIII., p. 273, by Jacoby.

Weber-Liel. — Die Aquaeductus des Labyrinths. "Centr. Blatt f. d. Medic. Wissensch.," 23 December, 1876, p. 929.

Weber-Liel. — Experimente betreffend die Frage der Uebertragung der Schallwellen auf's Labyrinth in Fällen von Synostose der Steigbügel-jorhof Verbindung. "Monatschr. f. Ohrenh.," 1876, II.

Wildermuth, H. A. — Die lufthaltigen Nebenräume des Mittelohres beim Menschen. "Zeitschr. f. Anat. u. Entwickelungsges," II., 5, 6. Refer. in "Centr. Bl. f. d. Med. Wissensch.," 23 Juni, 1877, by Loewe.

Zuckerkandl, E. — Ueber die Vorhofswasserleitung des Menschen. "Monatschr. f. Ohrenh.," 1876, No. 6.

II.

PATHOLOGY AND THERAPEUTICS.

BY SAMUEL SEXTON, M. D., NEW YORK.

THE literature of otology for the past year furnishes much that is of interest in the department of pathology and therapeutics. Dr. Dalby, aural surgeon to St. George's Hospital, has continued his contributions to aural surgery. In the "Lancet" of January 22, 1876, his third article treats of closure of the external auditory meatus. He thinks dilatation is only temporary in cases where the thickening occurs from the irritation of discharges. Where exostosis is the cause of closure, and repeated syringing will keep the canal clear of secretions, he recommends no further interference. But should the canal become completely obstructed, causing great deafness or serious trouble from retained secretions, an attempt should be made to remove the growth.

Two modes of operating are mentioned: First, by the constant current. In one case three needles were introduced into the growth, and a current from six elements of Stöhrer's battery was passed for three minutes. Two weeks later this was repeated, and three weeks afterwards the growth was so loose as to be readily extracted, and the patient made a good recovery. In all cases holes cannot be drilled, owing to the hardness of the growth, for the introduction of the needles. In one case facial paralysis followed the operation, owing probably to the inflammation excited in the middle ear.

A second method suggested is the use of the dentist's drill, but its application is not mentioned in any case. Dr. Arthur Mathewson, of Brooklyn, however, reports a case operated upon May 21, 1876. The patient was placed under the influence of ether. The integument was removed from the exostosis by scraping with a dentist's scaler.

Elliott's suspension dental engine was then used to propel

the burrs which had been ground down to square drills for the operation. The growth was perforated at several points near its centre by a drill one and a half millimeters in diameter. Larger drills, two and a half and three millimeters in diameter, were successively used to enlarge the perforations, run them together, and by lateral pressure ream out the meatus. The drills penetrated with ease, although the growth was very hard.

The movements of the instrument were readily controlled, it being held in the hand like a pen. The operation required thirty minutes, and owing to the bleeding the operator could not see what he was doing, but was obliged to rely upon the guidance of a probe.

The result of the operation, after some weeks of closure of the meatus by the swollen integument, was an almost complete restoration of the calibre of the meatus, and a return of hearing.

Dr. D. H. Goodwillie, of New York, a practicing dentist, in December, 1872, soon after the dental engine first came out, constructed revolving knives to be used with the engine for the removal of necrosed bones of the mouth and nares. In these operations he has been very successful with the instrument.

He has recommended it to otologists for the removal of bony growths situated in the meatus. It can also be used for trephining the mastoid.

Dr. Goodwillie prefers White's engine, the power of which is carried to the instrument by a wire cable within a hollow case. It can be run in any position.

It should be borne in mind that these knives *cut*, and do not scrape like a burr. When contained in the sheath the knife can be made to cut by passing the instrument between the osseous body and the walls of the meatus; or if there is not room sufficient for this, it can be presented *against* the object and pushed forward as it cuts its way.

The knives can be made of different sizes. The number of revolutions per minute most suitable for operations is about one thousand five hundred. The engine is capable of making two thousand five hundred.

Dalby devotes his fifth article to fatal cases of diseases of the middle ear. He divides them into two classes: those occurring soon after acute inflammation of the tympanum, and those following a chronic purulent condition. The first are dismissed as unavoidable deaths. The second he notices at length. The details of cases are given where the fatal result was probably averted by timely treatment. Dizziness is mentioned as the most common symptom calling our attention to these serious cases.

Epileptiform fits are frequent, and the presence of polypoid growth is common.

That many cases with grave symptoms present are now successfully treated is an evidence of the progress of otology.

Dr. Dalby's sixth article is upon syphilitic affections of the ear. He states that, next to scarlet fever, inherited syphilis may be regarded as the most fruitful cause of deaf-mutism, as it occurs in children who are born with good hearing power.

The writer's experience for many years in the large charitable institutions in New York devoted to diseases of the ear, would not lead him to similar conclusions.

Dr. Dalby regards the disease as essentially a nervous one, and the time at which the patient usually becomes deaf is in early childhood — after he begins to talk — or the period between this and puberty. The difficulties in making a diagnosis in these cases between nervous deafness and a faulty conducting apparatus are mentioned.

The seat of the lesion in the former is as yet undetermined. It may impair the functions of the auditory nerve in the labyrinth, or before its termination in that structure.

In affections of the ear from acquired syphilis he has observed that deafness is seldom total, and that both ears are usually affected at the same time. Only once has he seen a case of total deafness, and it recovered after six months' treatment directed to the constitutional disorder.

He gives our countryman, Dr. Roosa, credit for his researches on this subject, and coincides with Dr. Roosa in the belief that the inability of the patient to hear high notes may

locate the lesion in the cochlea. Their combined experience impresses one with the importance of a long sustained course of constitutional remedies.

Where the affection shows itself by an extension from the fauces through the Eustachian tubes to the tympanum, the symptoms are the same as in cases of ordinary catarrh.

Dr. J. Hughlings Jackson, in an address on nervous symptoms with ear disease, refers to them as follows: First, Neuralgia. Second, Bell's Paralysis. Third, Scrofulous Tumor of the Brain. Fourth, Cerebral or Cerebellar Abscess and Meningitis. Fifth, Pyæma. Sixth, Hemiplegia. Seventh, Epilepsy or Epileptiform Seizures. Eighth, Aural Vertigo.

Some of these cases can only be said to be *associated* with ear disease. Referring to cerebral abscess, he says in some cases of chronic ear disease he has found in the cerebrum or cerebellum a mass of tubercle, in the place, so to speak, of an abscess from ear disease. The symptoms of these cases seem to differ from those of cerebral abscess only in chronicity. They were not tubercular meningitis. The literature of the subject is ably presented.

Dr. W. R. Gower publishes a series of articles on the diagnosis of auditory vertigo. Ménière's vertigo, a morbid state of the organ of hearing, Dr. Gower states, has passed from the presence of special aural surgery into that of general medicine, for the reason that the symptom of vertigo has usually little apparent connection with its actual cause. The gastric symptoms often mislead both the patient and his medical adviser. The evidence on which the pathology of the disease is based is, first, the frequent association of paroxysmal vertigo with defect or disturbance of the function of the internal ear or auditory nerve; secondly, on some scanty pathological facts, which point to the existence in these cases of a morbid state of the semicircular canals; and lastly, on the well-known experimental evidence of the connection between the function of the semicircular canals and the maintenance of the equilibrium of the body.

The question of the mechanism of the action and disturbance of the semicircular canals is not entered into.

Dr. Gower reports some cases of labyrinthine vertigo.

The most important point in the diagnosis of auditory from gastric vertigo is deafness. Another symptom is tinnitus; and the loss of the power of hearing a watch in contact with the skull is a most significant change. The point of next importance is the character of the vertigo. The sensation which results from a primary disturbance is usually vague, a confused sense of defective equilibrium; that which results from a labyrinthine affection is definite, a sense of movement in a certain direction, subjective or referred to other objects. Dr. Gower is convinced that in a vast majority of cases in which vertigo is definite and uniform, and apparently excited by gastric disturbance, an auditory defect will be discovered on careful examination.

The diagnosis from cerebral disease, apoplexy, and epilepsy, is given, and will be found of great interest.

As to prognosis, in many cases it is a very obstinate affection; but a considerable amount of relief may be afforded; in several cases immunity for long periods has been obtained. The bromides, quinine, salicylate of soda, etc., are recommended.

Dr. A. E. Cumberbatch reports two cases of paracentesis of the membrana tympani for the evacuation of accumulations of mucus following subacute catarrhal inflammation of the middle ear. The tympanum was washed out daily with a solution of carbonate of soda for a few days, the fluid being forced through the tympanum to the throat. The cases selected for the operation were similar to those recommended by Schwartze, who has recently proposed to revive the operation in cases of catarrhal inflammation of the tympanum where the mucus secreted neither escapes by the Eustachian tube nor bursts through the membrane, but remains within the tympanic cavity. Dr. C.'s cases resulted very satisfactorily, the hearing being much improved in both. He believes the operation to be safe.

Hinton, who practiced this operation and reported several successful cases, relied mostly upon passing the injected fluid

from the meatus through the tube, while Schwartze and others adopted almost exclusively the opposite plan of injecting the fluid from the Eustachian tube through the tympanum.

Although Hinton spoke favorably of this operation in his work on "Aural Surgery," published in 1874, otologists seem to hesitate to adopt it as they did the operation of tenotomy of the tensor tympani for tinnitus aurium. Could the diagnosis of accumulations be always unmistakable, the operation would doubtless be tried more often than at present.

Dr. Urbantschitsch, in an article on the modification produced upon the sense of taste and the salivary secretions by purulent inflammation of the middle ear, relates his experiments made upon fifty patients.

In forty-six cases the author found the sense of taste anomalous. In four cases only of uniliteral otitis, the taste was preserved intact on both sides. His tests were made with a variety of substances — sweets, acids, salt, and the like — applied to different parts of the mouth, tongue, and pharynx, in order to determine the normal taste. He regards the alteration of function as depending upon the compression or partial destruction of the chorda tympani or the tympanic plexus.

The augmented sensibility of taste, etc., depends upon an irritation of these nerves.

Dr. Dreyfus-Brissac reports an interesting case of thrombosis of the right lateral sinus, from an internal otitis. The patient was a female aged thirty-seven, suffering from a uterine tumor. The case resulted fatally on the sixth day after the aural symptoms manifested themselves.

Dr. Lévi, of Paris, publishes in the "Annales des Maladies de l'Oreille, du Larynx," etc., an article entitled, "Étude Historique et Critique sur le Cathétérisme de la Trompe d'Eustache et les Divers Procédés en Usage pour faire pénétrer de l'Air comprimé dans l'Oreille Moyenne." He gives the literature upon this subject from the recommendation of Valsalva to utilize the Eustachian passages in the treatment of middle ear diseases down to the present time. Mention is made of Guyot, a village postmaster, the inventor of the first Eustachian cathe-

ter, 1724, and then follows in historical order an account of the modifications of Cleland, 1741; Boyer, 1818; Itard, 1821; Kramer, 1836; Gairal, 1836; Delau, 1838; Triquit, 1857; Bonnafont, 1860 to 1873; Giampietro, 1863; Gruber, 1870; Tillaux, 1875.

After describing the various instruments used by these authors, and their methods of using them, Dr. Lévi thoroughly describes the manner of douching the middle ear with air by means other than the catheter.

Dr. Robert S. Cooper recommends an ear speculum for the removal of foreign bodies. It is constructed with a spout-handle, and has a scoop-nozzle; the scoop end is passed between the foreign body and meatus, and is so constructed that the water passes *over* the end of the scoop from the ribbon-shaped opening of the bore, which is placed *above* and somewhat short of the semi-flattened scoop-like extremity.

I have found that a small stream of water projected by a syringe with considerable force against the side of a foreign body, will pass by and *beyond* it more readily than any instrument can, and the return current will bring the object within easy reach of the entrance of the meatus.

Dr. James Patterson Cassells urges that those who breathe habitually through the mouth are more liable to deafness than those who breathe through the nose with the mouth closed. This is owing, he claims, to the fact that intra-tympanic tension is necessary for the perfect function of the apparatus of hearing, and that open nostrils and nasal respiration are essential factors in the maintenance of this normal balance of tension between the intra- and extra-tympanic air-passages.

He relates some observations which tend to the conclusion that nostril breathing is natural, and that in childhood we should attempt to compel such breathing.

He refers to an interesting statement made by Catlin, a traveler among the American Indians, who visited one hundred and fifty different tribes living in a savage state. Among this large number — two (2) millions (?) — he states there were found only three or four deaf-mutes, and not a single individual who was either dull of hearing or deaf.

(I have always supposed aural disease must be quite frequent among a class so much exposed to the inclemencies of our northwestern climate, and accounts are quite frequent of the natives who, while smoking, force the smoke out of their ears.)

He explains the fact (?) by stating that it is the custom of Indian mothers to train their children to breathe with the mouth closed.

Dr. Cassells has published an article on "Ear Disease and Life Insurance," which is of practical importance, and a valuable contribution to that subject.

The connection between Diseases of the Organ of Hearing and the Nervous Trigeminus, is the subject of a paper by Professor Moos of Heidelberg. He divides these diseases into (1) those of purely cerebral disturbance of the acoustic and the fifth nerve, in which the sensory portion only of the fifth is affected; and (2) cases in which organic affection of the hearing organ is present, generally acute or chronic purulent inflammation of the middle ear, with disturbances of the trifacial, the latter having commenced when the hearing organ had become affected.

He relates some illustrative cases, together with the treatment resorted to.

A new means of diagnosing the anomalies of the tympanic cavity is given by Professor Gruber, of Vienna. He observes that when a tuning-fork is vibrating close to the healthy ear, and Valsalva's method is used, the sound is decreased by the increased outward tension of the membrana tympani.

If the patient, when this experiment is made, fails to notice that the sound is decreased, the membrane has already a *plus* tension outwards; but if the patient hear better under the experiment, there is a *minus* tension.

The vibrating tuning-fork placed on the head during Valsalva's experiment will be heard better in the normal ear, but if there be *plus* tension, the sound will be unchanged. If there be *minus* tension, the sound will be decreased, the membrane transmitting sound better than when lax.

In the "Medico-Chirurgische Presse," Professor Gruber, re-

ferring to artificial membrana tympani, prefers usually the use of cotton-wool to Toynbee's elastic membrane, for the reason that it is more adaptable to the conditions of the natural membrane, a continuous chain for the conduction of sound being formed. He often uses this kind of artificial membrane for the application of medicaments in preference to dropping solutions in the ear.

The relations of ear disease to insanity are shown by the report of the case by Dr. Williams. The patient, an inmate of Bethlem Royal Hospital, was on admission noisy, violent, and sleepless. In a few days he became quiet and sullen. In a fortnight after admission he again became excited and violent, when a profuse purulent discharge from the left ear was noticed. He stated that he had had this for months past. Hearing seemed unaffected. Slowly a large puffy abscess formed over the left mastoid, extending up over the squamous portion of the temporal bone. On pressure, pus escaped into the meatus. This swelling increased for a month, but the patient was regarded as too dangerous to be examined. A month later, however, the abscess was opened under the ether-spray, and he became sane at once. No further discharge took place from the ear. A fortnight later, under chloroform, a free incision was made, but a careful exploration failed to detect any cause for the discharge. For some time the patient complained of severe frontal headache and general malaise, but the wound healed, and the patient improved in every way. After watching him six weeks he was discharged well. The origin of the abscess was doubtful. It extended deep in between the mastoid and parotid glands, but no diseased bone was anywhere found.

Several cases have recently been observed at the Bethlem Royal Hospital in which mental symptoms have abated on the onset of acute maladies, especially when implicating cranial nerves.

Dr. Williams is unable to state whether there was propagated an inflammation of the brain or a mere conduction of disease along a cranial nerve.

Dr. Hanbury Smith, when superintendent of an asylum for

lunatics, mentions several cases in which aural disease was intimately connected with the mental disturbance, in some holding the relation of cause to effect. Twenty-six years ago, when Dr. Smith wrote, attention had scarcely been called to this subject, and he is among the first to suggest the importance of making a thorough examination of the organ of hearing in connection with the treatment of lunatics. As institutions were then conducted, Dr. Smith could have had but little time to study the department of otology, but his observations, made so long ago, should have certainly been more productive of results in this much-neglected field.

Under the heading of "Some Practical Remarks on Aural Affections," Dr. Jones, of Cork, is publishing a series of articles, profusely illustrated with drawings of the instruments employed by aurists.

Although but little new or original is advanced, the articles may serve to attract the attention of the general practitioner to a subject he should undoubtedly be more familiar with.

Dr. George P. Field read an article before the Harveian Society, London, on the graver aspects of otorrhœa.

The animal parasites which are frequently found in the external auditory meatus of the lower animals are described by Trautmann. In deer, Dermonyssus, or Hühnerlaus, has been found, as recorded by Von Tröltsch, causing inflammation with excessive secretion. Dr. Trautmann has found in the ears of sheep, dogs, and rabbits the Dermatodectus Caniculi. He has seen them present in the external, middle, and internal ears, but he thinks they are not capable of boring through a healthy membrana tympani. He believes that, having found their way into the tympanic cavity, they are able to pass through the membrana tympani secundaria. Before their entrance into the labyrinth, the rabbit shows little or no sign of discomfort, but, on their gaining an entrance there, the head was held in an oblique position, and a loss of equilibrium was noticed in attempting to move. Shortly after this, symptoms of meningitis set in, and death soon followed.

Though these animal parasites have not been found in man,

the Doctor advises that children ought not to be allowed to fondle rabbits, dogs, or sheep, lest, the animals being affected by these parasites, the children might receive them.

Dr. Wagstaffe recommends a new dilating speculum auris, constructed on the model of the tracheotomy canula. The instrument is expanded by a series of levers acted upon by a large milled head, by which the dilatation is controlled. It has a large polished external orifice, and is capable of being highly illuminated.

Several otologists during the past year have again drawn attention to the education of deaf-mutes. The number seen in the institutions devoted to treating diseases of the ear in New York indicates that there should be greatly increased facilities for teaching this class at the public expense.

Deafness during pregnancy, Dr. Pierce, of Manchester, thinks, begins with that state. Mr. Lennox Browne regards such cases as common, and believes they are not catarrhal, but a thickening of the mucous membrane. Sometimes they are nervous in character.

Dr. Alexander Morrison describes a modification of Seigel's otoscope. It is a miniature Brunton speculum with exhausting tube attached. The advantage claimed is that, on account of the reflecting mirror in the speculum, the observer looks directly on the membrane through a lens placed parallel to the eye.

Those who have labored under the disadvantage of using Seigel's obliquely placed lens can appreciate the advantage of Dr. Morrison's suggestion.

In this connection it may be stated that Dr. Purves, of Guy's Hospital, frequently uses Seigel's otoscope for the purpose of drawing out the tympanic membrane. The most prominent advance, however, in the use of Seigel's otoscope as a means of elevating the drum-head, was made by Dr. Pinkney, who used the flute-key lever-syringe of a stomach-pump as a means of suction. This was undoubtedly an important step, as ordinary suction by the mouth is in many cases totally insufficient.

Iodized preparations are urged as applicable in the treatment of most diseases of the ear in childhood by Dr. Ladréit de Lacharrière. As an injection in purulent inflammation he recommends the following proportions: Aquæ, 1000; tr. iod. 30; iod. pot., 4; to be used night and morning. He bases this suggestion upon the belief that scrofula is the most frequent cause of otorrhœa in childhood.

In an article on aural polypi he recommends as a cautery chloride of zinc made into sticks by the addition of a little wheat-flour; a little morphia is also added to the mixture.

Hardy, in an article published in the Paris "Médicale," discusses circumscribed meningitis and Ménière's disease.

At a meeting of the Medical Society of London, in January last, Dr. E. Wookes read a paper on the sympathy of the ear and mouth. The frequent inflammation of the ear and otalgia caused by the presence of a decayed tooth or sore on the tongue were explained by the fact that fibrillæ belonging to the vaso-motor system of nerves mingled with those of the cerebro-spinal system; the former set of fibrillæ being brought into reflex relationship with the nervi vasorum distributed on the arteries of the part reflexly affected by means of the sympathetic ganglia, in which the two sets of fibres communicate. In this way it was shown that distinct channels of communication existed between the vessel nerves which regulate the supply of blood to the ear, and the otic ganglion, while branches of the fifth nerve connecting the carious tooth and ulcers on the tongue also communicate with this ganglion. Morbid impressions affecting the latter would influence the former, and thereby produce vascular distention of the drum-head and contiguous regions, producing a veritable hyperæmia of these parts, to the consequences of which pain and inflammation were referred. Dr. Wookes explained what may be a frequent cause of spasmodic croup; a communication existing between the nervi vasorum of the vessels of the larnyx and the auriculo-pneumogastric nerve supplying the meatus. Cold draughts of air falling upon the ear would, through sympathy, be the cause of spasmodic croup. Laryngitis may thus occur from the presence of a foreign body in the meatus.

Nothnagel collects valuable facts, in a late volume of Ziemssen, on thrombosis of the cerebral sinuses in connection with aural affections.

Huguenin, in the article on inflammations of the brain and its membranes, contributes also to the literature of otology. He recognizes the frequency of the transmissions of inflammation from the temporal bone to the regions treated of. He says abscesses of the brain which are secondary to affections of the ear appear to be slightly more numerous than those which arise from injury. The affected part may be caries of the bony portions of the external auditory canal, as well as caries of the walls of the tympanic cavity, of the walls of the labyrinth, and finally of the mastoid process. After giving the most frequent seat of abscesses, he explains how the affection of the ear may lead to suppuration of the brain. Some abscesses are directly continuous with perforations of carious bones, but perforation of the bone is not a *conditio sine qua non* for the existence of an abscess of the brain.

Many cases are on record where the surface of the bone was perfectly intact; where, indeed, the existence of caries could not be positively demonstrated. Those interested in the subject will find the whole article very instructive.

The literature of this subject has been recently written up most ably by J. Orne Green, of Boston, in a brochure reproduced from the reports of the Boston City Hospital. Dr. Green presents the subject in an unusually clear manner.

Dr. Roosa reports a case of meningitis resulting fatally in twenty-eight days from the appearance of aural symptoms. The affection began as an acute *otitis media catarrhalis* with impacted cerumen which the patient thought was a facial neuralgia. Dr. Roosa calls attention to the rapid advance of the disease.

The danger attending the introduction of fluids into the nasal passages by means of the nasal douche has continued to interest aural surgeons in this country and abroad.

The weight of evidence is undoubtedly against recommending the use of the ordinary nasal douche so called.

Dr. Buck goes further than this in regard to the use of fluids in these passages, and objects to the use of the atomizer.

Dr. Shaw relates eighteen cases where injury was done the middle ear by various means of flooding the nasal passages. In sixteen cases the liquid was introduced by the nasal douche and syringe, in one by the Valsalvian method, and in one by snuffing into the nostrils.

Mr. Lennox Browne agrees with the majority of otologists upon this subject, in a late publication in which the subject is referred to.

The writer hereof once was compelled to cease using a powder which was smartly blown into the naso-pharyngeal vault. Its use produced an irritation of the middle ear. The powder used was in part composed of the persulphate of iron. The patient suffered from chronic naso-pharyngeal catarrh and catarrh of the middle ear as well. A rhinoscopic examination showed a very free opening of the Eustachian tubes at their pharyngeal termination.

Paulson recommends the use of carbolic acid in otorrhea without disease of the bone or the presence of polypi. He uses the acid one part to ten of olive oil. He avoids the frequent use of the syringe, and applies the remedy upon a small portion of cotton-wool, leaving it *in situ* until the next day, when the process is repeated if necessary.

Blake reports a peculiar form of obstruction of the external auditory canal which is described as being more pasty in character than the ordinary cerumen plug, and intermingled with flakes of yellowish sodden epidermis; the pasty mass is invested with a thickened layer of epidermis clinging closely to the lining of the canal.

It is found that this mass will not yield to ordinary syringing with water, but is best removed by aid of probe and angular forceps. Blake found in some cases great assistance from a saturated solution of carbonate of potash applied to the centre of the mass, carried by means of cotton-wool rolled upon the end of a probe. The resulting saponaceous mass was easily removed by syringing.

Agnew, in an article on otitis and its relations to "taking cold," recommends that those subject to colds should learn to endure draughts: first, by diminishing the morbid sensibility of the body by graduated exposure and friction of the skin in a daily air or sun bath, followed by such local sponge-baths as may be attended by speedy reaction.

The temperature of the water first used must not be lower than 80° Fahr.

The first air-bath should only consist of a few brisk turns across the bed-chamber. After a little practice the exposure may be increased to twenty minutes, and the temperature of the water used in washing accommodated to that of the outer air. At least four times a week, the patient while taking the air-bath, and *before* using the water, should rub the entire surface of the body briskly with "hair mittens and strop."

The object to be kept in view is to gradually and systematically lessen the morbid sensibility of the body by *daily* exposing the *entire* skin surface to air, light, friction, and cleansing, in an atmosphere as nearly as possible at the prevailing temperature.

This brief mention gives only the most suggestive portion of an article which is characterized throughout by the author's peculiarly forcible manner.

The Otological Section of the International Medical Congress of 1876 met in Philadelphia, September 4 of that year. Dr. Buck, of New York, Dr. Burnett, of Philadelphia, Dr. Blake, of Boston, Dr. Spencer, of St. Louis, and others read papers. The entire proceedings not having been published, it is impossible to give here a complete notice of the meeting.

Dr. Swan M. Burnett, of Washington, D. C., reports a case of diplacusis binauralis. The phenomena described occurred in a patient aged fifty-nine. Dr. Burnett also reports a case of restricted range of audition.

The results of experiments with nitrate of amyl in tinnitus aurium are given by Dr. J. Michel, of Hamburg. He says the tinnitus in which the remedy is suggested is especially the hypertrophic form of middle ear disease, and in affections of

the labyrinth. He was led to employ this remedy from its well-known sedative action upon the sympathetic system, especially the vaso-motor nerves, and the fact that many forms of tinnitus aurium are caused, not by an increased intra-labyrinthine pressure (Politzer, Weber), but occur as the result of nervous irritation of the auditory nerve, or of hyperæmia, or anæmia of the brain or the internal ear, — the tinnitus resulting from the administration of quinine, salicylic acid, and other drugs, for example, being explained only in this manner. The remedy was employed in twenty-seven cases by himself, and in six cases by Dr. Urbantschitsch. A greater or less improvement occurred in nineteen cases. Among these were three in which the tinnitus disappeared entirely from one ear, and in the other was somewhat diminished. In four cases, a by no means inconsiderable improvement in the hearing was observable.

Three cases passed from observation. In the majority of cases there was an otitis media hypertrophica ; of the cases not improved, one, and of those improved, two, were labyrinth disease. Of the cases improved, one also was a purulent inflammation accompanied by polypi.

From one to five drops of the remedy was inhaled at a sitting.

The inhalation was continued during the appearance of the usual symptoms, flushing of the face, injection of the blood-vessels of the eye, etc., and suspended on the occurrence of vertigo. In all the cases improved, the tinnitus was increased during the period of inhalation. As the flushing of the face disappeared, the tinnitus diminished, and became less than before the application ; the duration of the improvement after an inhalation was very varied. At the time of writing — three months — the improvement had persisted in one case. The details of cases are given, but they would take up too much space for this report.

This remedy has recently been employed in twenty cases by Dr. Spencer, of St. Louis, who was careful to select those cases which presented the most favorable conditions for its adminis-

tration in the absence of any mere mechanical cause upon which the entotic noise could rest, and he reports the result to have been wholly negative beyond a mere temporary impression.

Professor Moos, of Heidelberg, enjoyed an unusual opportunity to study the histological changes that occur in the Eustachian tube from chronic catarrh, in a patient aged forty-one, who had suffered from catarrh of the ear since his ninth year.

Professor Moos had this patient under his own treatment for ten years. For a stenosis of the tubæ Eustachii in consequence of this catarrh, Professor Moos undertook to open and dilate the tubes by means of catgut bougies. In this he was quite successful.

The patient died later, of some pulmonary disease, at the age of forty-nine, having in the mean time become worse than ever as to his hearing, etc.

In a lengthy account of the condition in which he found the tubæ Eustachii in this case, he first draws attention to the relative size of the osteum pharyngeum tubæ in its normal condition. It is seldom the same on both sides of the same individual. In the adult the sagittal diameter varies from 4.5 to 6.5 millimeters; the transverse diameter, from 4 to 5 millimeters. The depth of the cone is 5 to 6.5 millimeters.

He emphasizes the fact that when the ostea pharyngeum tubæ are remarkably small in the adult, in the absence of other causes we may feel tolerably sure of the existence of a long-continued catarrhal disease of the mucous membrane of the Eustachian tubes.

As to other changes, the folds in the mucous membrane upon the floor of the tubæ were notably absent.

The folds in the mucous membrane opposite the floor of the tube below the curving of the medial into the lateral cartilages were totally wanting on both sides.

The conclusion is drawn, therefore, that one of the results of chronic catarrh of the Eustachian tube is a smoothing out of the folds of mucous membrane. This favors a more intimate contiguity of the opposite surfaces of the tube than in the normal condition. As is shown further on, the smoothing of

the folds is the result of increased activity of the muscles by whose contraction the canal is opened, — the abductor tubæ and the salpingo-pharyngeus muscles.

The mucous membrane in cases of chronic catarrh is often partially or wholly absent; owing, perhaps, to the increased frailty of the epithelial cells.

The submucosa, transformed by catarrh, presents a hyperplasia of the connective tissue; the fibrous layer is thicker and broader than normal. The muciparous glands are atrophied and absorbed.

Professor Moos believes that the tube, which is closed during rest, is dilated partially through the immediate or remote influences of musc. abductor tubæ, partially by the action of the superior and middle constrictors of the pharynx, by means of the fascia salpingo-pharyngea, which is in simultaneous action with the pharyngeal muscles. If this view is correct, it might reasonably be expected that a hyperplasia of the organs concerned in dilating a tube where there has been disease of its canal for a series of years, with continued and increasing obstruction to the dilatation, would occur. In fact, his surmises proved to be correct. The fascia salpingo-pharyngea was thoroughly hypertrophied.

The hyperplasia was characterized by a very dense quality of the connective-tissue bundles, partly by a broad ligamentous expansion of certain tendinous prolongations. This was particularly noticeable in parts where the prolongations were inserted into the cartilaginous island on one side, and the submucosa of the floor of the tube on the other. The hyperplasia of the perichondrium led to an increased development of the intercellular substance of the cartilage, and in some portions of the tube the bands of connective tissue had penetrated between muscular bundles of the musculus levator, and gave the appearance of insular isolation of these portions.

Other striking changes were found, but sufficient has been here gleaned from the article to indicate the very interesting character of these researches as a whole.

Professor Moos concludes that this state of things is the

result of long-continued catarrh and of the increased labor demanded of the muscles of the part. In view of the fact that, in the normal condition of these parts, muscular fibre is never found in this situation, we may suppose a new formation of muscular fibre — a true (muscular) hypertrophy — to have occurred: provided, always, that we do not chance to meet a very rare individual peculiarity in the exceptional insertion of the muscle, — a thing which nobody has as yet noted.

The changes in the cartilage were not of sufficient importance to be entitled to notice here.

Dr. L. Brewer Hall reports two cases of aspergillus in the ear. After some comments upon this subject he arrives at the conclusion that aspergillus glaucus in the auditory canal is rare in this climate; that the aspergillus is not the cause of the disease, but in order of time is a secondary phenomenon. The simplest effective treatment is to keep the meatus free and dry.

Dr. Roosa has been at the pains to observe the disproportion between the power of hearing the tick of a watch and the human voice in thirty-six cases. No cases were recorded where the watch could not be heard at all, or where it could be heard on one side only. Dr. Roosa's article is of greater interest than his apologetic remark at the opening would indicate. He says: "I am aware of the comparatively slight importance of the subject, but I hope the few facts shown may at least turn the attention of some observers, so that a careful working up of the questions involved may finally accomplish something for otological science."

Dr. Roosa refers to the importance of our possessing a good test or standard for testing the function of the hearing organ. We have, however, as yet been unable to acquire a satisfactory means.

It is to be regretted that the entire article cannot be given here. One deduction from the article is, that those cases are the least amenable to treatment in which the watch is heard relatively better than the voice. The conclusion of the article is devoted to the subject of hearing better in the midst of a noise.

Dr. Blake, in a paper published in 1875 ("Arch. Opth. and Otology"), reported a case of movable cicatrix of the membrana tympani; the character of the movements of the cicatrix, the conditions under which these movements occurred, and the results of the tests to which these conditions were subjected, proving conclusively varying degrees of intra-tympanic pressure during natural respiration and during phonation, which could be explained only by assuming a persistent patency of the Eustachian tube.

In the "Archives of Oph. and Otology" for August, 1876, Dr. Blake presents a second case, confirmatory of the one mentioned above.

A new work upon the ear, by Dr. Charles S. Burnett, of Philadelphia, has appeared during the past year. Its title is, "The Ear: Its Anatomy, Physiology, and Diseases."

It is divided into two parts, the first being devoted to Anatomy and Physiology, the second to Diseases and Treatment.

The illustrations of the book are well selected and are not too profuse.

The author adopts the metric system of measurements in his descriptions, anatomical and otherwise.

Dr. Burnett's well-known reputation as a scientific student would lead us to expect a very full account of the latest researches in otology; and in perusing the pages of his book one is not disappointed. Every department is thoroughly worked up.

We have the benefit of his thorough sifting of the latest literature upon the subject, in addition to his own mature observations. The first part deserves special mention for its lucidity and thoroughness. The chapter on "Instruments and Methods of Employment" is a complete statement of the subject. That on sound-hearing and tests of the latter is carefully written.

The author recommends the use of the nasal douche for irrigating the naso-pharynx in acute and chronic affections of the middle ear. He thinks if every precaution laid down by him is resorted to, the operation can always be conducted with safety to the patient.

As the book will soon be in the hands of all, it is needless now to dwell upon a subject upon which there is such a diversity of opinion as the use of the nasal douche.

It is carefully prepared throughout, and is a valuable addition to the few good books written by otologists of late years.

July 1877—July 1878.

Dr. Grellé[1] has conducted researches as to the condition of the middle ear of the fœtus. He finds that it is filled with gelatinous smegma and contains no air. The smegma begins to disappear at birth, as air enters the cavity of the tympanum. The entrance of air, he says, is due to the act of respiration and the derivation of blood to the territory opened up by the circulation. The thick reddish smegma now grows pale and is absorbed. As the body of the smegma disappears, a thin coating only remains, and little by little it disappears as the cries and efforts at sucking favor the entrance of air into the tympanum. When all proceeds well, complete aeration of the cavity takes place in a few moments; rarely it occupies a few hours, — twelve at most. If, however, respiration is feeble, if asphyxia, rapid or slow, takes place, the aeration of the tympanic cavity is incomplete, — exists only on one side or not at all.

In these cases, notwithstanding the presence of air, the fœtal condition may still be recognized, and where the examination of the lungs is impossible, signs may thus be found in the ear, confirmatory or nugatory, of the child having expired. It should be remembered in these examinations that death by hæmorrhage can induce, through anæmia, artificial productions in the cavity of the ear, and that aural catarrh often exists at the time of birth, preventing aeration of the tympanum.

In medical jurisprudence the state of the middle ear often proves a valuable criterion, for when an examination is made long after burial the smegma will be found to have resisted decomposition an almost indefinite time.

[1] *Dublin Journal of Medical Sciences.* "A Report on Medical Jurisprudence." By Stewart Woodhouse, M. A., M. D. February, 1878.

Dr. Buck[1] contributes a valuable paper, read before the International Medical Congress, on the importance of treatment of aural diseases in their early stages. The paper contains a tabular statement of fifty-eight cases where paracentesis of the membrana tympani was performed for the relief of symptoms depending upon accumulations in the tympanum.

Dr. F. M. Pierce,[2] of Manchester, refers to a patient who, after taking a cold bath, had ear-ache; and when seen by him four days afterwards, the patient was found in bed, pale, anxious, perspiring, with intense pain over vertex and left side of face, neck, and jaw. The patient had been treated for cerebral inflammation, and his friends had given up hope of his recovery.

Dr. Pierce found a collection of cerumen which syringing failed to remove, but it was brought away piecemeal by the use of forceps. Relief was instantaneous, and the next day he was almost well. Another case, somewhat similar to the above, is reported by Dr. G. P. Field,[3] where a well-known surgeon succeeded in removing only a portion of the accumulation by syringing; and, mistaking the honeycomb appearance of that which remained, considered that the patient had lost the tympanic membrane of the right ear and nearly all of the left. By careful syringing Dr. Field removed the cerumen from both ears and found the membranes quite healthy. The use of the air-douche by means of Politzer's air-ball is recommended in these cases, after the cerumen has been removed.

A case is reported in the "British Medical Journal"[4] of a child dying whilst attempts were being made to extract a bead from its ear. A post-mortem examination showed there was no bead or other foreign body in the ear. Dalby,[5] in comment-

[1] *The Importance of Treatment of Aural Diseases in their Early Stages, especially when arising from the Exanthemata.* By Albert H. Buck, M. D. Reprinted from the *Transactions of the International Medical Congress.* Philadelphia, 1876.

[2] "Accumulations of Cerumen." A Lesson. *Medical Times and Gazette.* March, 30, 1878.

[3] "Impacted Cerumen having the Appearance of an Ulcerated Membrana Tympani." *The British Medical Journal.* October 6, 1877.

[4] *The British Medical Journal.* December 8, 1878.

[5] "Foreign Bodies in the Ear." By W. B. Dalby, F. R. C. S. *The British Medical Journal.* December 15, 1877.

ing on this case, says he has known instances of the destruction of the tympanic membrane and injuries to the tympana occurring in a similar manner. He is surprised that death is not more frequently the termination of these operations, if such a term be applicable to them. Mr. Dalby says it cannot be too often repeated that, with the exception of a vegetable substance, which swells rapidly as it absorbs water, or a living insect, no foreign body in the ear, *left alone*, can possibly be injurious, and that any subsequent injury is the result of manipulation by inexperienced hands. All students at hospitals, he urges, should be taught that so long as they live they are to abstain from any attempts whatever to remove a foreign body from the ear unless they have learned to use their hands at the same time that the external auditory canal is thoroughly illuminated from a mirror worn on the forehead. Dr. Cassells,[1] in indorsing the above, instances the removal of a small pebble which had remained in the external meatus for fifteen years without injury to the ear.

Mr. Habgood, in the "British Medical Journal" of January 5, 1878, in connection with this subject, relates a case where he removed from the ear a piece of the broken shaft of a cedar pen-holder, one quarter of an inch in length, which had been introduced thirty years before. It was embedded in a collection of cerumen, and had in no way injured the ear.

The same journal, in the number for January 26, 1878, contains a pendant to the last-mentioned case from the practice of Mr. Lennox Browne. The patient was a female aged thirty-eight, who presented herself with the request to have removed from the left ear a piece of black lead which had been introduced at play when she was a child aged eight. The attempts made to remove it at the time were intensely painful.

The ear was found by Mr. Browne to be blocked with impacted cerumen. With the exit of the first syringeful of water something clicked on the bottom of the glass held to receive it, which proved to be a piece of black lead pencil, such as is used by carpenters, three eighths of an inch in length.

[1] "Foreign Bodies in the Ear." By James Patterson Cassells, M. D., M. R. S. C., London. *The British Medical Journal.* Dec. 29, 1877.

Dr. H. Macnaughton Jones[1] writes at length upon the subject of the removal of foreign bodies, and urges the importance of a knowledge of the anatomical structure of the meatus, lest the operator harm the patient. The Doctor recommends the almost exclusive use of the syringe in these cases.

Dr. Charles H. Burnett[2] read a paper on the aspergillei before the Philadelphia Pathological Society, April 11, 1878. Dr. Burnett thinks the aspergillei grow in the ear more often than is suspected, and that, in fact, they show a more marked tendency to grow in the human ear than any other fungus. Dr. Burnett describes the inflammation produced by their presence as rather peculiar. The Doctor exhibited to the Society a specimen of A. nigricans, which nearly filled the meatus, and which, owing to its attachment to the drum-head and meatus, was removed with difficulty. After the removal of this mass some spores remained which were treated by the instillation of diluted alcohol, after which the various portions of the ear soon assumed their normal appearances and functions. Dr. Burnett describes two varieties as seen by him, the presence of which sooner or later produces sufficient inflammation to cause considerable suffering to the patient.

The treatment is to remove the growth by syringing, care being taken that no spores are allowed to remain, else in a day or two the mass may be reproduced.

In reference to the etiology of this affection the writer says his experience leads him to believe that dampness, and the squalor of the poor, are not so fruitful causes as has been supposed, but that he has seen more cases among those living in good hygienic surroundings, or even in luxury. He thinks the presence of cerumen is a protection from the invasion of the meatus by aspergillus, as the latter seeks a secluded spot for growing, and cerumen is rarely found in a normal quantity or condition in an ear invaded by aspergillus.

[1] "Foreign Bodies in the Meatus." By H. Macnaughton Jones, M. D. *The British Medical Journal.* Jan. 19, 1878.

[2] *The Growth of the Fungus Aspergillus in the Human Ear.* By Charles H. Burnett, M. D. Reprinted from *The Philadelphia Medical Times,* 1878.

Dr. Duncanson,[1] of Edinburgh, reports a case of A. nigricans occurring in the ear passages of a young woman living in favorable hygienic circumstances. The membrana tympani in both ears was entire, but there was chronic eczema of both meatus. This patient had been under observation a long time, coming for a fortnight's treatment every six or eight months. Until relieved she had a sense of fullness and tinnitus. She was treated with a solution of one grain of corrosive sublimate to one ounce spiritus vini rectificatissimus of the German pharmacopœia, and as the disease improved the solution was weakened by the addition of rose-water. At first it was applied four or five times a day until all the flakes and epidermal scales were removed by syringing with a strong alkaline solution, and as these were removed the original strength was reduced.

Dr. Edwin Bartlett[2] reports five cases of this parasitic disease. He regards long-continued discharges from the ear as usually causing this growth, which then becomes a source of secondary disease, and increases the irritation which already exists.

Buck[3] describes a class of cases in which a desquamative process from the mucous membrane and skin of the middle ear and external auditory canal is a characteristic and important feature. He cites cases in point, and adds his own experience as similar to that of Wendt and Wredin, Kipp of Newark, and Blake.

In an ordinary typical case of inflammation of the external auditory canal, says Dr. Buck, a certain amount of desquamation almost always occurs, but for some unaccountable reason, in the cases under consideration, the inflammatory process seems to have displayed its chief activity in the production and shedding of epithelium in continuous laminæ of considerable

[1] *Report of One Hundred Cases of Diseases of the Ear.* By J. J. Kirk Duncanson, M. D., F. R. C. P., Edinburgh. Reprinted from *The Edinburgh Medical Journal.* March, 1878.

[2] "On Aspergillus." A paper by Edwin W. Bartlett, M. D. *Transactions of the Wisconsin State Medical Society,* 1877.

[3] "Desquamative Processes in the Ear." By Albert H. Buck, M. D. *N. Y. Medical Record.* Dec. 15, 1877.

extent. The microscope in these cases will show that the membranes are composed of large, flat, well-defined, polygonal, non-nucleated epithelial cells, with here and there a crystal of cholesterine, and they thus can be distinguished from diphtheritic or fungous affections. Should these exudations be mistaken for accumulations of cerumen, a few syringefuls of water will make the diagnosis easy, for it will nearly always remove the latter, while the former requires the patient use of instruments. For their removal Buck relies upon the bent forceps, curettes, etc., but cautions those who are not familiar with these instruments not to attempt their use.

As regards the etiology of exostoses of the external meatus, Dr. Cassells [1] is of the opinion that aural exostoses and hyperostoses are totally distinct affections; that an exostosis is benign and only to be found on the outer half of the external meatus, is *always* attached at the posterior wall, is pedunculated, and has its origin in the periosteum of the mastoid close to the meatus. Dr. Cassells regards the origin and development to be as follows: At the outset, a subperiosteal abscess forms over the mastoid, and makes its way out and into the meatus by way of the line of junction between the cartilaginous and osseous portions of that canal, — sometimes even through the cartilage itself, — discharging itself, and continuing to do so for some time. By and by, highly vascular, granular-like growths sprout from the opening of the abscess and go on increasing in size, while at the same time they are being gradually changed into bony tissue in their interior by the gradual conversion of their cells into bone cells.

The final size of the osseous tumor, as well as its form, is determined by the original size and form of the granular-like growths.

After the process of ossification has been completed, no further increase takes place in the size of the tumor.

Dr. Cassells recommends the early removal of the soft growths, and the free incision of the abscess. He prefers, for

[1] "On Etiology of Aural Exostoses." By James Patterson Cassells, M. D., M. R. C. S., London. *The British Medical Journal.* Dec. 15, 1877.

the removal of the bony growth, the écraseur of Wilde, armed with a fine steel wire; but where the tumor so fills the meatus as to prevent the use of this instrument he would try electrolysis.

Mr. Lennox Browne [1] agrees with Cassells as to the etiology and pathology of exostoses, and reports a case. A man aged thirty-five had been totally deaf in the left ear for four years. There had been for eight years a discharge and gradually increasing swelling, which became denser as it grew. There was intense facial neuralgia on the same side. The obstruction when examined by a probe proved to be a spherical bony tumor, covered with skin, and attached to the posterior wall by a narrow bony pedicle. Attempts to wrench it off by forceps proving unavailing, the dermal covering was removed and a hole drilled in the tumor with the "American" tread-drill. (The moment the growth was perforated the patient heard the watch at some inches.) The tumor was now easily evulsed with a pair of fine tooth forceps, and was found to measure two inches in circumference.

There was but little pain or hæmorrhage attending the operation, and the patient regained perfect hearing. Mr. Field [2] also reports a case of osseous tumor. It followed the removal of a polypous growth in a girl aged three. It almost filled the meatus, was pedunculated, and about the size of a pea.

Mr. Field regards this case as well illustrating the etiology of aural exostoses, as seen by the light which modern pathology has thrown upon inflammation of bone and resulting new growths of this tissue.

Mr. Field, in referring to Cassell's description of these growths, regards them as being only one form of the disease. Such tumors, he says, when pedunculated, may indeed be removed by the wire, as suggested by Cassells, but there is another and far more serious form of exostosis, of ivory consistency, — still less frequently met with, — partaking of the na-

[1] "On the Treatment of Exostoses." By Lennox Browne, F. R. C. S., Edinburgh. *The British Medical Journal.* Dec. 22, 1877.

[2] "On the Etiology of Aural Exostoses; Osseous Tumor following Extraction of Polypus." By George P. Field, M. R. C. S. *The British Medical Journal.* Feb. 2, 1878.

ture of a new growth, and quite independent of inflammatory changes. Such growths of bone in other parts of the body would be called hyperostoses, and as such he presumes Cassells would class them. Their development is insidious, and they occur in apparently healthy organs. The presence of these growths may not be suspected by the patient until rapidly increasing deafness is discovered, and the absence of pain would lead him to regard it as a trivial matter.

Mr. Field had such a patient under his care, and after the administration of chloroform, many hours' patient work with the "American" drill was necessary to perforate the thick mass of ivory-like bone completely filling each external meatus.

Green [1] reports a fatal case of exostosis of the auditory meatus, occurring in a man aged twenty-three, the son of a physician. The patient was first seen by Dr. Green in 1869, when fourteen years old. He had suffered from otorrhœa since the age of three. One year and a half before he was seen by Dr. Green a polypus had been diagnosticated, occupying left meatus.

Dr. Green found the left meatus two thirds closed by two exostoses, one arising by a broad base from the anterior wall of the meatus, the other by a still broader base from the posterior wall.

When again examined in 1874, the meatus was not closed, and there was no serious inconvenience from retained discharges.

In 1876, however, Dr. Green found the meatus nearly closed from an increased growth of the exostoses. An operation was now considered; but it was thought the complete closure might afford protection to the tympanum, as it was without any collection; and the existing slight, thin discharge could afterwards escape by the permeable Eustachian tube.

Upon the entire closure of the meatus, which occurred in a few weeks, cerebral symptoms set in. Dr. Green, being sent for, — the patient was not under his immediate observation, —

[1] "Exostosis of the Auditory Meatus; Death from Meningitis; with Remarks." By J. Orne Green. *Boston Medical and Surgical Journal.* April 18, 1878.

perforated the exostoses as soon as possible, using for that purpose a hand-drill ; the opening made was three millimeters in diameter.

The mastoid was then trephined with an instrument seven millimeters in diameter, the antrum mastoideum being finally reached by means of a small hand-drill. Syringing through the meatus now brought from the mastoid opening a mass of grumous material.

Relief was only temporary, and the patient died of basilar meningitis in about one week from the first appearance of the cerebral symptoms, and the fourth day after the operation. There was no autopsy. Dr. Green thinks the confined secretions finally caused an affection of the bone, which extended to the brain. He regards the exostoses as the direct cause of death, and believes that their early removal would have prevented the complications which proved fatal.

In commenting on this class of cases Dr. Green draws attention to the fact that there is a period, in most cases of threatened meningitis from tympanic inflammation, of from one to ten days, which he styles the period of meningeal irritation, in which the patient experiences more or less cerebral pain, especially in the temporal region, photophobia, mild delirium, or confused intellect, etc.

It is during this period that he advises the operation for opening the tympanum and mastoid, to be followed by douching of the tympanum and mastoid cells.

Dr. Green thinks he has, by this operation, averted the more serious brain symptoms in several instances.

In Dr. Green's experience the pedunculated variety is infrequent and comparatively unimportant, he having seen but one instance. But of the variety having a broad base he has seen seven instances, all in men. Of these seven cases, three had normal drum-membranes, and four were associated with chronic purulent inflammation of the tympanum. Dr. Green inclines to the belief that our present knowledge of pathological processes in general points to an inflammation of the periosteum as the origin of these developments.

Since the introduction of the dental engine by Dr. Mathewson, for the perforation of osseous growths in the meatus, their treatment has become more successful. By the use of Dr. Goodwillie's cutting-drill the operation is still further simplified. Indeed, there is no good reason why this instrument, in connection with the engine, should not be used for perforating the mastoid process. The drill can be made to cut an opening of any size required; it is held in the hand, when used, as a pen, and the cutting into the bone may be regulated by the pressure exerted as easily as when writing. The rapidity of the revolutions of this instrument render it almost painless, and in many instances the use of an anæsthetic can be dispensed with. In no other department of otology has greater advances, as regards pathology and treatment, been made than in the one just noticed. It is only a few years since it was considered unwise to attempt the removal of osseous growths from the external auditory canal, and the treatment usually consisted in the application of various absorbent medicaments locally in connection with the internal use of the iodides.

A case of molluscous tumor of the ear is reported by Dr. Duncanson.[1] It was complicated with polypous growths, and a fistulous opening behind the ear communicated with the external ear and stretched upwards to a cavity on the temple situated two inches above the auricle under the muscular structures. After the polypi had been successfully removed, a mass as large as a small walnut was, after considerable difficulty, syringed away from the posterior wall of the meatus deep down in the tympanic bone. It proved to be of a sebaceous character. The case made a good recovery.

Professor Grüber and others are of the opinion that fatal ear affections mostly originate in the external meatus, and the case reported by Dr. Pierce,[2] senior surgeon to the Manchester

[1] "Case of Molluscous Tumor of the Ear." By J. J. Kirk Duncanson, M. D., F. R. C. P., Edinburgh. *Edinburgh Medical Journal.* November, 1877.

[2] "Fatal Case of Caries of External Meatus; Otorrhœa and Secondary Affection of the Brain." *The British Medical Journal.* April 20, 1878.

Ear Institution, is one belonging to that class. The patient was a man of fifty-six years, who had suffered from slight otorrhœa of the left ear for six years. He was rather suddenly attacked with pain in the affected ear, followed by nausea, giddiness, etc., soon afterwards.

Four days after the beginning of the attack Dr. Pierce was called in consultation, and found the patient in bed, on his back, almost comatose, moaning and constantly twitching the eyelids and face, and picking the bed-clothes. The skin was bathed in a cold, clammy perspiration. The pulse 100, respiration 50.

In front of the left tragus, over the temporo-maxillary articulation, there was a hard, tender tumor, like an enlarged gland, which had developed within the past twelve months. There was no affection of the mastoid process.

An old perforation of the membrana tympani existed, and there was pus in the meatus. On the superior wall of the meatus, near the membrana tympani, a small spot of carious bone was discovered.

Dr. Pierce enlarged the opening in the membrane, incised the meatus, and applied leeches. The patient, however, gradually sank, and died the same day.

The necropsy, twenty-eight hours after death, showed blood oozing from the left ear. On opening the skull, a large quantity of fluid, black blood escaped from the cerebral sinuses, which were much congested, as were also the vessels of the dura, which was opaque and thickened over the anterior half of the hemisphere.

On raising the dura mater, the whole surface of the anterior half of the left cerebrum, from about one inch from the longitudinal sinus down to the surface of the petrous bone, was covered with thick, yellow, creamy pus. A careful examination of the cranial surface of the petrous bone failed to discover any caries or lesion which could account for the presence of the pus.

The brain substance was free from any abscess, and the ventricles contained no effusion.

Although the course of the inflammatory process in this case could not be traced, Dr. Pierce did not doubt that the ear disease stood in the relation of cause to the subsequent inflammation of the brain.

Mr. Gribbon,[1] of the British army, reports a case of fatal ear disease, resulting from exposures in using the plunge-bath, which in India is recommended as a sanitary measure. The patient was a stout soldier aged twenty-two, and had had a discharge from the right ear for some time, — attributed to the plunge bath, — when he was taken with headache, torpid bowels, and a little numbness on the right side of his face. Headache increased, in a day or two becoming acute over the occiput. A tendency to vomiting was present, together with the usual symptoms of profound cerebral disturbance. On the sixth day his head was raised slightly for the purpose of administering a powder, when a gush of purulent fluid came from the ear, and he died in little more than a minute.

At the autopsy, twenty-four hours after death, nothing unusual was observed in the condition of the membranes, the superficial vessels, or the cerebral substance. The ventricles, on slicing off the cerebral substance, were found partly distended with clear, or rather opalescent fluid.

The surface of the cerebellum, close to the right auditory meatus, was discolored, and there was pus between it and the bone. The whole interior of the cerebellum, except about the anterior third of the median and left lobes, was occupied by an abscess of extremely fetid character. At a point corresponding to the right auditory meatus, the cortex was ruptured, so that the contents of the abscess could escape freely through the aural canal.

The bone was denuded of dura mater for a quarter of an inch around the meatus, and was stained with pus, which also was abundant in the mastoid cells. Mr. Gribbon expresses his belief that this abscess began to form while the man was

[1] "Case of Abscess of the Cerebellum bursting into the Ear, with immediate Death." By G. C. Gribbon, M. D., Surgeon Major, Army Medical Department, in Medical Charge of the 25th Regiment. *The Lancet.* May 18, 1878.

performing the routine of military duty, and he is surprised that so little evidence of the existence of this large abscess manifested itself during life.

The stage of the disease in this case, when the mastoid became affected, does not appear to have been noted.

Abscesses of the middle lobe, or cerebellum, may evacuate their contents through the frontal bone, ethmoid, etc., but the favorite channel is doubtless through the temporal. A knowledge of this fact no doubt has served to confuse the minds of many as regards the diagnosis of cases, and in consequence the pathology of the subject has been greatly obscured.

An instructive case, illustrative of this point, has been recently reported:[1] A healthy man, who was a carpenter by trade, after laboring one hot July day, was affected with the usual symptoms of sun-stroke, from which he never recovered further than to be able to go about much of the time until he died, nine months afterwards. Five months subsequent to this attack he had measles, and well-marked inflammation of the right middle ear, of an acute character. A purulent discharge was thus established, after which he experienced partial relief.

The discharge from the ear continued, however, and he could not sleep because of the pain in his head. He would request his father, who sat up with him at night, holding his head, to "sit on it;" "put it in a vise." About this time — four months after the ear began to discharge — he died. The reporter gives no account of the symptoms for some time before the death of the patient. At the autopsy, which was on the day after the patient's death, "the membranes over the right ear were found thickened, softened, covered with purulent matter, and detached from the petrous portion of the temporal, which was dark, and its cavities were filled with pus. The middle lobe of the cerebrum was softened in nearly its whole extent. Just above the petrous portion there was an abscess, the size of a very large hen's egg, having a sac quite the sixteenth of an inch thick. Dividing through the bones,

[1] "From the Brain to the Ear." By E. Chenery, M. D. *Boston Medical and Surgical Journal.* Dec. 27, 1877.

the cells were filled with pus down into the mastoid process, and there was no doubt that the matter discharged from the ear came from as high up as the dura mater."

The reporter, after some comments on the case, observes: "The natural and likely conclusion is that the disease was primarily of the encephalon, and secondarily of the ear, and that the latter was consequent upon the former."

There is every reason for trusting in the sincerity of the reporter of this interesting case, although it is difficult to reconcile his conclusions with the history of the case and the post-mortem appearances found in the head. It is likely that there was a hyperæmic condition of the ear, induced by the disease from which he had suffered for five months, and that the attack of measles was thus more likely to be attended by an aural inflammation. That the mastoid cells were soon involved seems probable.

Altogether, from our present knowlege of the pathology of these cases, it seems more probable that the disease, in this instance, extended from the ear to the brain, than the contrary.

Dr. Berudgen,[1] of Münster, places on record a case in which he claims that the inflammatory process passed from the brain to the tympanic cavity. From the course of the disease and the post-mortem appearances this unusual result seems to have occurred.

Dr. Turnbull,[2] in giving directions for trephining the mastoid cells, cautions against directing the perforating instrument on a line with the upper part of the auditory canal, on account of the danger of entering the horizontal or sigmoid fossa or sinus. He directs the operator to insert the instrument at an equal height with the opening of the auditory canal, but not at the upper edge; and to carry the opening horizontally and a little forward, not upward. Dr. Turnbull reports a case of mastoid abscess upon which he operated successfully, using a drill

[1] *Monatschrift für Ohrenheilkunde.* No. 3. 1877.

[2] "Observations on Perforation of the Mastoid Process, with a successful Case." By Lawrence Turnbull, M. D. *The Medical and Surgical Reporter.* Philadelphia. Feb. 2, 1878.

for that purpose, and following the directions given above as to the course the opening should take. Before Dr. Turnbull saw this patient, who was a man of forty-two years, with a purulent discharge from the left ear since childhood, the following incident occurred. Being subject to attacks of giddiness and oppression, during which the eyes were directed upward, etc., when the discharge was checked, he found relief by picking, or, rather, forcibly scraping or digging into the meatus as far and as deeply as possible, with a pencil or other object, until a free discharge of pus was again established.

During one of these efforts, while reading a newspaper, he probed too deeply, and an attack of convulsions resulted, with partial paralysis.

The pathology of mastoid abscess is well recognized by Woimand, — "Thèse de Paris," 1877, — who gives a description of this affection. He points to two distinct causes of this condition: one from periostitis of the external auditory canal, propagated by continuity of tissue as far as the level of the mastoid process; and inflammation of the mastoid cells, which reaches the face of the bone either by continuity of tissue or by the perforation of the external lamella of the process.

Purulent diseases of the middle ear are regarded as the causes of this affection. For the treatment of osteo-periostitis M. Duplay uses leeches and other antiphlogistics. Should they not prove successful he has recourse to a long vertical incision, made about one centimeter from where the auricle joins the head, and carried down to the bone. He does not wait, before operating, for suppuration to take place.

In the event of an abscess of the mastoid cells, his rule is to trephine. After making a suitable incision through the integument, for this operation, the trephine is applied on the point of intersection of the vertical line of incision and of a horizonal line touching the upper septum of the auditory canal in front. A horizontal direction, slightly forward and from without inwards, is given to the instrument, and a course is then followed parallel to the external auditory canal. If the membrana tympani should be found intact, it is to be perfo-

rated, and the middle ear and cells washed out with a stream of water.

Although the subject of branchial fistulæ may usually be more properly relegated to the field of morphology, it has for us an important pathological bearing, and when more thoroughly investigated it may be the means of greatly increasing our knowledge of the abnormities existing in certain individuals. We are indebted to Sir James Paget [1] for an account of branchial fistulæ observed in the ears of seven members of one family. "The persons in whom they were found were a gentleman and his sister, and five of his eight children; and the same gentleman, his father, his sister, and four of his children had each one or two branchial fistulæ at the sides of the neck.

These fistulæ were found on the helix at its superior-anterior aspect. The orifices were narrow, the very slender canals extending downwards rather more than half an inch in the adults. In no instance did they secrete, or occasion any trouble.

After referring to the six or seven similar cases heretofore published, and to other malformations of the external ear, probably due, like these, to imperfect closure of the post-oral branchial fissure, the reporter states that there are now sufficient evidences of malformations due to incomplete closure of every one of the branchial fissures; and he then refers to the relation between these cases and those of supernumerary ears.

Such ears, he believes, are found only over the lines of former branchial fissures, and may be regarded as cutaneous opercular growths, homologous, though abnormally, with the natural auricles.

Many persons born with aural branchial fistulæ have become deaf, and are thus instances, however slight, of the general law indicated by Dr. Allan Thomson, that malformations of the external ear are often associated with other defects in parts formed in or near the first or mandibular arch.

[1] "Cases of Branchial Fistulæ on the External Ears." By Sir James Paget, Bart., F. R. S. *The British Medical Journal.* Dec. 1, 1877.

In connection with the above Dr. Allan Thomson showed drawings of three cases of malformation of the external ear, in which one or more fistulous openings were also found. In two of the cases there was complete occlusion of the external meatus ; defective development of the lower jaw characterized another, indicating the connection of the malformation with the post-oral arch and parts connected therewith. These subjects were not complete deaf-mutes, although there was great deafness ; and there was a rather indistinct power of speech.

The third case was a young man who heard pretty well, and could readily communicate with others, as well as receive instruction. This case was particularly interesting, as the ear passages were entirely closed, and he apparently received the sound vibrations through the cranial bones, presenting the top of his head for this purpose, while listening at the same time with his hands covering the sides of his head and the defective ears. It was also ascertained by Dr. Thomson, by experiments made with the tuning-fork, etc., that this person heard through his head.

In all cases of closure of the meatus externus, the conducting apparatus has been absent, a mass of bone being found to occupy its place. Any attempt to relieve these cases by an operation must, therefore, prove unavailing, although Sir Astley Cooper had attempted to do this in one of the cases which Dr. Thomson now mentioned ; and the late Professor Miller of Edinburgh, in another.

Dr. Urbantschitsch,[1] whose researches upon the subject of this anomaly of formation are quite extensive, takes a somewhat different view of the matter. In the first place, he cannot see that this canal is in any sense an ear fistula. He regards it as simply a remainder of the normal manner which in its entirety is the fully closed first branchial cleft. Urbantschitsch regards the external and middle ear as in no way arising from the first branchial cleft, but that on the one hand the middle ear is developed from a lateral sinus of the mouth,

[1] "Fistula Auris Congenita." *Monatschrift für Ohrenheilkunde.* Berlin. July, 1877. [From *Edinburgh Med. Jour.*, Feb., 1878.]

nose, and pharyngeal cavity; whilst on the other hand the external auditory meatus proceeds from that formative mass which raises itself like a wall rampart above the original drumhead, as it then exists in the level of the external covering.

The membrana tympani is then the external boundary wall of the lateral sinus of the mouth, nose, and pharyngeal cavity.

Dr. Urbantschitsch states that although a purulent looking discharge may issue from the fistulous opening simultaneously with disease of the tympanum, a connection of the external or of the middle ear with the fistula channel, which proceeded from an arrest of development in the sphere of the first branchial cleft, could, however, not be explained from the standpoint of the hitherto generally adopted origin of the Eustachian tube, of the tympanum, and of the external auditory meatus. The fistula, he says, always appears on the right side only, and he infers from this fact that the inheritance of this anomaly of formation arises from the common stock of both branches of the family. The branchial fistula always appeared with the first-born, and repeatedly remained limited to them. It has been frequently observed that several generations are passed over without an appearance of the anomaly. Dr. Urbantschitsch finds the openings usually about one centimeter above the tragus, and one or two millimeters in front of the helix, running from without inwards and forwards, and admitting a thin probe or bristle to the depth of several millimeters. Urbantschitsch refutes the statement of Pflüger that the fistula communicates with the middle ear; and he states that Schmitz was unable to inject water into the tympanum through these fistulous openings. These abnormalities are doubtless more frequent in occurrence than the record shows. They have by some observers been described as situated lower down than is mentioned by Urbantschitsch. The total number of cases described by Heusinger and others now amounts to above sixty.

Some investigations have been made by Professor Roser[1] of Marburg, with a view of explaining those cases of injury to the head, in which recovery takes place after a discharge of

[1] *Archiv für Klinische Chirurg.* Bd. 15. Heft 3, 1877.

cerebro-spinal fluid, and an extrusion of small portions of brain substance from the ear.

Roser observes that he found the partition between the auditory canal and the brain to vary greatly in thickness. In some cases it was unusually thin, in others there was an increase in thickness, made up in part of spongy bone.

In some instances he found the tympanic cavity extending upwards and outwards over the roof of the meatus, and in some instances this roof contained air-cells in communication with the tympanum. The middle cranial fossa, and the inferior temporal convolution of the cerebrum are so intimately connected with the upper wall of the auditory canal, that slight injuries of the meatus may be attended by penetration of the skull and a wounding of the meninges of the brain.

The conclusion arrived at is that the prognosis in injuries of the head, with aural discharge of cerebro-spinal fluid and extrusion of brain substance, is not so unfavorable as it is generally supposed to be, since these symptoms do not necessarily indicate extensive fracture of the petrous process and of the base of the cranium. Professor Roser cites three cases confirmatory of this conclusion, in one of which a penetrating slit was discovered in the roof of the meatus by means of the aural speculum, the membrana tympani being intact. In the majority of cases, however, the membrane is ruptured.

Professor Roser, moreover, thinks it possible that the discharge may exist independently of any direct lesion of bone, inasmuch as the cerebral meninges having been ruptured, and the bone exposed, the cerebro-spinal fluid may transude into the auditory canal.

Dr. Spencer,[1] of St. Louis, has prepared a *résumé* of the experiences of others in the use of the artificial drum-head, and to this he adds his own observations as to their utility. From this paper we learn that the first appliance of this kind was suggested by Marcus Bauzer in 1640. Other appliances

[1] "The Function and Utility of the Artificial Drum-membrane." By H. N. Spencer, M. D. Extract from the *Transactions of the International Medical Congress*. Phila., Sept., 1876.

were suggested from time to time for the *protection* of the tympanum until 1840, when Yearsley accidentally discovered that artificial membrana tympani, under certain circumstances, improved hearing. The substance used by Yearsley was a pellet of moistened cotton wool inserted to the bottom of the external meatus. Since Yearsley made his experiments numerous individuals have directed their attention to this subject. The greatest benefit as yet, however, has been derived from the simple moistened pellet of cotton wool.

The attempt to carry medicated substances to the tympanum by means of appliances devised to answer as artificial drum-heads, has not met with much favor. We have as yet not discovered any appliance which can be used to restore the abnormal conducting apparatus to any satisfactory extent. All artificial membranes made of extensible material, like soft rubber, are likely to fail as mechanical appliances, as they are in no way a substitute for the normal inelastic membrane. Besides, they are likely to irritate the parts with which they are long kept in contact.

After the declaration that the use of the Eustachian catheter will *never* fall into disuse, Grüber[1] remarks that other means of ventilating the tympanum are, for many reasons, desirable. To him there are many objections to the procedure as now practiced. He dislikes the plan of Politzer, which requires the patient to sip water, and he therefore suggests as a substitute therefor the utterance, by the patient to be operated upon, of the syllables "hack," "heck," "hick," "hock," "huck," thereby causing the tongue to be pushed backwards and firmly upwards against the soft palate, thus separating the upper part of the pharynx from the lower. Forcible expiration accompanies these utterances, and the operator at the same instant empties the air-ball into the nasal passages. Dr. Grüber does away with the rubber tubing commonly used to connect the ball with the nose-piece, preferring to use a nozzle

[1] "A New Method for dilating, or rendering pervious the Eustachian Tube, and for ventilating the Tympanic Cavity." By Dr. J. Grüber, Vienna. *The Lancet.* Jan. 12, 1878.

which is screwed directly into the ball. Dr. Grüber justly remarks that the success of the operation depends in all cases upon the intelligence of the patient. From the language of Dr. Grüber it may be inferred that he is in the habit of instructing some of his patients to continue this method of treatment on themselves.

The necessity which is felt to exist of cleansing the nasopharynx in the diseases of that cavity where accumulations are retained has induced many aural surgeons to still adhere to the practice of flushing those parts with fluids, either medicated or not.

In the United States, however, the reluctance felt by aurists in pursuing this course of treatment has been marked, since Dr. Roosa [1] first pointed out its dangers ten years ago.

Dr. Cassells,[2] of Glasgow, gives his personal experience in a number of instances which were unattended by any untoward result, and is opposed to an abandonment of this method of treatment.

Dr. Weber-Liel,[3] of Berlin, in a paper read before the Hufeland Medico-Chirurgical Society, agrees with the authority last mentioned. He also instances a large personal experience as free from any unfavorable results. Dr. Weber-Liel not only instituted experiments upon rabbits, to prove the harmlessness of the nasal douche, but also experimented on his own person. He explained the physiological difficulties usually encountered, and gave minute directions for overcoming them. Dr. Weber-Liel does not believe the entrance of fluids into the middle ear to be so dangerous as is generally supposed. He advises the use of warm solutions of soda as being always safe in his

[1] "A Case of Pyæmia from Suppurative Inflammation of the Cavity of the Tympanum, induced by the Use of Weber's Nasal Douche." By D. B. St. John Roosa, M. D. *Archives Ophthalmology and Otology.* Vol. I. 1869.

[2] "On the Use and Abuse of the Nasal Douche, and on the alleged Danger attending the Introduction of Fluids into the Nasal Passages." By James Patterson Cassells, M. D., M. R. C. S., London. *The Dublin Journal of Medical Science.* June, 1877.

[3] *Berliner Klinische Wochenschrift.* April, 1878. [From *Medical Record.* London. May and June, 1878.]

hands. Indeed, he is not alarmed when such a solution finds its way into the tympanum; but when the tympanum and Eustachian tubes are in a state of hyperæmia they are more liable to be inflamed by the douche.

When a patient feels any discomfort in the ears after the use of the nasal douche, the doctor advises him to tie up his ears and keep quiet the rest of the day. Such symptoms of discomfort are, he says, developed in from four to ten hours.

Weber-Liel administers the douche by means of a syringe having a glass barrel, and a nozzle which closely fits the nose. In conclusion, he affirms that if salt water be excluded and a solution of soda used we shall have no more trouble.

Dr. Spencer,[1] of St. Louis, in giving the results of his observations as to the benefits to be derived from the use of the douche, says that great caution is required in its use, in order to obtain benefit for our patients without doing them a corresponding injury.

Unfortunately for the laity, so long as the nasal douche continues to be used in the hands of the profession, they will not be deterred from occasionally giving it a trial on their own responsibility.

As an additional means of inspecting the naso-pharynx, Zaufal[2] has introduced specula constructed with the view to being introduced through the inferior meatus of the nose. The set consists of five specula, ranging in length from 10 to 11.5 centimeters, and having a calibre from 3 to 7 millimeters in diameter. They are round tubes, with a funnel-shaped extremity, and are made of either silver or vulcanite. When constructed of silver they are polished. When it is desired to examine the naso-pharyngeal cavity by means of these specula, they are introduced along the inferior floor of the nasal passage. Any one accustomed to rhinoscopy will have no difficulty in using these specula. It is claimed that the mouth of

[1] *The Middle Ear and its Relations to Certain Methods of Treatment of the Naso-pharyngeal Space.* By H. N. Spencer, M. D. Read before the Medical Association of the State of Missouri, 1877.

[2] *Archiv für Ohrenheilkunde*, vol. xii., part 4.

the Eustachian tubes can be well seen by this means, as well as other parts which cannot always be brought into view by means of the rhinoscope.

The specula for operations can be made bivalvular.

In an article on discharges from the ear, Grüber [1] strongly insists that the diseased spot should always be found before remedies are applied. Remedies, consisting of solutions of astringents, etc., when instilled into the ear in an objectless manner, are liable to be mischievous in their results, often increasing the discharge dependent upon the suppuration of polypous growths or chronic or acute suppuration of the middle ear. The insufflation of powders is likewise objected to on the ground that they may be deposited on places where they may prove injurious, or be detained in crypts of the meatus, where if cleanliness be neglected concretions may form with the discharges and increase rather than diminish the inflammation. Grüber thus considers that otorrhœa has frequently been greatly over-treated, and in such cases, when they come under his observation, he pursues an expectant course until he can ascertain the exact condition of the affected part, and separate the actual disease from conditions which have been induced by the treatment adopted. Dr. Grüber now makes frequent use of medicated plugs of charpie, which are introduced into the meatus and allowed to remain until the medicament is slowly dissolved by the discharges. He also uses globular or almond-shaped portions of medicated gelatine in the same way. Where there is obstruction of the meatus from hypertrophied tissue, he recommends the use of plugs of laminaria digitata, which may be smeared with a suitable ointment before being introduced.

Dr. Field [2] reports a number of grave cases met with in his practice at St. Mary's Hospital, and is led to comment on the disposition still manifested, to let alone affections of the ear. Dr. Field adds the report of a fatal case of meningitis result-

[1] *Allg. Wein. Med. Zeit.*, Jan. 1 and 8, 1878.

[2] "On the Graver Aspects of Otorrhœa." By George P. Field, M. R. C. S. *The Medical Press and Circular*, June 6 and 20, 1877.

ing from chronic purulent inflammation of the middle ear, to the already large list of these cases.

Stifler [1] of Munich, accounts for the relaxation, atrophy, etc., of the membrana tympani. They depend, in his opinion, upon affections of the dermoid or mucous layers, which secondarily affect the middle layer, and occasion softening, molecular disintegration, and absorption of this fibrous layer. The development or increase of the vessels of these layers, infiltration and exudation, capillary compression, or partial obliteration of the vessels, is usually owing to a hyperæmic state of the membrane, either acute or chronic.

Increased concavity of the membrane, acute and chronic myringitis, superficial ulcerative processes of the dermoid layer, mucous or purulent accumulations in the cavity of the tympanum, are the results which take place in the later stages of the hyperæmic condition. The rapid breaking down of the membrane and subacute purulent inflammation of the middle ear, sometimes seen in the last stages of consumption, may be thus explained.

Grüber [2] publishes some observations concerning the arched or spanned conditions of the healthy membrana tympani in the human subject.

His researches have led to the conclusion that the hopper shape of the membrana tympani does not depend upon the peculiar union of the membrane with the malleus handle, but upon the individuality, so to speak, of the membrane itself. Grüber's experiments were made upon carefully prepared specimens from the dead body, and they showed that in the normal condition of the membrane the tension of its different parts varied considerable more than has heretofore been supposed. His tests were made by the gentle pressure of a probe upon the membrane. Grüber found that the posterior segment in all his specimens yielded most readily to the pressure. The anterior superior quadrant was the most resisting. The

[1] *Aertzliches Intelligenz-Blatt*, July 18 and 25, 1877.

[2] *Monatschrift für Ohrenheilkunde*. Berlin, 1877. [From *Edinburgh Medical Journal*, Sept., Nov., Dec., 1877.]

posterior inférior quadrant yielded most. Grüber also experimented upon these membranes as to the effect of punctures and incisions. The results from the former were of but little interest, but he found that cuts made in the anterior segment gaped more than those made in the posterior segment, which was owing, he inferred, to the greater elasticity of the fibres in the former. Grüber further illustrated the movability of the membranes by blowing against them by means of a current of air directed through the Eustachian tube, and as expected the most yielding point was found to be at the posterior inferior quadrant. Referring to the abnormities of the spanning and vaulting of the drum-head, Dr. Grüber concludes that they are due to pathological changes in the membrane itself. In this connection Dr. Grüber deprecates, most emphatically, the habit of placing in the hands of patients the Politzer ball, and its too frequent use by the surgeon. Dr. Grüber's method of diagnosis is too well known to be repeated here, but his recommendations as to treatment are interesting.

For the restoration of the normal tension in a relaxed membrane, two operations are advised: myringotomy and myringectomy. The latter is to be preferred, and the galvanocautery instruments, devised for this purpose by Voltolini, are considered the best. Dr. Grüber has operated on several patients, and claims that the improvement, which was owing to the cicatricial contraction of the membrane, has been marked both as to a restoration of hearing and the disappearance of noises, etc.

Dr. Dieulafoy [1] observes that he has found various aural affections to exist in connection with Bright's disease.

In thirty-seven recorded cases, acute and chronic, of this affection, he found that fifteen had impairment of hearing to a greater or less degree. The deafness was more frequent in the advanced stages of the disease, and was frequently of only temporary duration: in one instance only was it permanent. The exact pathological condition was not ascertained.

From what we know of the increased arterial tension in

[1] *Gazette Heb.*, Jan. 23, 1878.

Bright's disease, important vascular changes, presumably, may be expected in the labyrinth, and the hyperæmic condition of the tympanum under these circumstances would give rise to structural changes in that portion of the ear.

Dalby [1] has continued the contributions to aural surgery, which were referred to in this report for last year.

In his eighth article, some examples of sudden deafness from fright, etc., are given, and he also refers to the injuries of the ear from working in a noise, the sudden sounding of a steam whistle, and blows upon the ear. For these affections the author does not propose any treatment.

M. Colladon [2] of Geneva, read a communication before the Geneva Medical Congress — Section Ophthalmology, Otology, and Laryngoscopy, — on tenotomy of the tensor tympani. The operation, says M. Colladon, was proposed on theoretical grounds by Hyatt, and has only been subjected to experiment within the last ten years. The operation has been employed to relieve disorders depending upon supposed prior shortening of the tensor tympani muscle, or its secondary contraction. The operation he regards as a simple one, and not difficult to perform, the surgeon having to avoid injury to the promontory and the articulations of the malleus with the incus. It is admitted that the operation has not been attended by any permanent success, inasmuch as there almost always exist in the middle ear pathological changes which the operation cannot affect. In consequence of the paracentesis of the membrane, in some instances there has seemed to be a favorable result. The effect of the operation, however, has been serious in some instances, owing to the subsequent violent inflammation, extending to the labyrinth, and increasing the deafness and tinnitus. M. Colladon predicts more favorable results from a method of operation recently proposed by Professor Troeltsch, which consists in the partial division of the tendon at its insertion

[1] "Contributions to Aural Surgery." By W. B. Dalby, F. R. C. S., M. B. Cantab. *The Lancet*, Aug. 11, 1877.

[2] "Transactions of the Geneva Medical Congress," reported for *The Medical Press and Circular*, Jan. 18, 1878.

into the handle of the malleus in instances where it has been shown that the insertion is abnormally low down.

In the discussion following the reading of the paper, Professor Weber-Liel, of Berlin, protested against the conclusions of the author.

The attention which aurists and others have of late given to abnormal conditions affecting the inner ear, has resulted in numerous contributions to the literature of the subject.

Mr. Lennox Browne[1] and Mr. W. Douglas Hemming[2] have contributed articles on the subject. The former reports some cases, going to show that tinnitus aurium frequently depends upon diseases of the general system; and the latter in an extensive résumé of the subject gives the results of his own extensive observations and a careful study of the subject.

The recent contributions of Dr. Edward Woakes[3] of London, have thrown much light upon this hitherto obscure subject, and they undoubtedly tend to enlarge the field of our special practice. The anatomical and physiological explanations of phenomena, heretofore seemingly inexplicable, point to the necessity of a revision of aural nomenclature, especially in view of the etiological researches of Dr. Woakes. Dr. Woakes, in the beginning, draws our attention to an apparently remote subject. He begins with a description of the inferior cervical ganglion, with its more important relations, as a necessary prelude to the subject. Dr. Woakes describes this ganglion as situated deeply behind the subclavian artery, very near the spot where the vertebral artery leaves it to enter the bony sheath constituted by the juxtaposition of the foraminæ in the transverse processes of the cervical vertebræ.

[1] "Note on Tinnitus Aurium." By Lennox Browne, F. R. C. S., Edinburgh. *The Medical Times and Circular*, August 15, 1877.

[2] "Tinnitus Aurium." By W. Douglas Hemming, M. R. C. S. *Student's Journal and Hospital Gazette*, March 30 and April 13, 1878.

[3] 1. "Noises in the Head: their Etiology, Diagnosis, and Treatment." By Edward Woakes, M. D. London. *The Lancet*, Feb. 9, 1878.

2. "The Etiology and Treatment of Occipital Headache." By same author. *The Practitioner*, April, 1878.

3. "The Connection between Stomachic and Labyrinthine Vertigo." By same author. *American Journal of Medical Sciences*, April, 1878.

Two or more cords from the ganglion enter this canal with the artery, forming the dense vertebral plexus which ramifies upon the artery throughout its course. During the ascent of the vertebral plexus it transmits outwards some branches which communicate with the upper trunks of the branchial plexus, and the lowest trunk of the cervical plexus of spinal nerves.

The ganglion also contributes branches to the subclavian, which finally accompany the brachial artery throughout its course.

From a view of the vagus nerve it will be seen that a branch proceeds to the ganglion from the point where the recurrent laryngeal leaves the trunk of the vagus.

Bearing in mind, says Dr. Woakes, that vaso-motor nerves, when associated with cerebro-spinal nerves, pursue for the most part an opposite course to the latter, it will be obvious that this communicating branch comes *from* the stomach to the ganglion. This nerve is the nerve of communication between the stomach and the inferior cervical ganglion; and establishes the correlation between this viscus and the extensive areas supplied by the vertebral and brachial arteries, whose innervation has already been shown to be mediated by this ganglion. The inferior cardiac nerve proceeds from this ganglion, — a relation which has an important bearing in some aural cases.

It is highly probable that nerves entering a ganglion communicate with the intrinsic caudate cells of the organ, by which means they are brought into communication with one another. It has also been shown that sympathetic ganglia enact the part of secondary vaso-motor centres, receiving and reflecting impressions independently of the general centre; and that they constitute correlating organs by means of which afferent impressions from distant regions are reflexly transferred in them to a totally different tract; the afferent impressions being manifested through their medium as afferent vaso-motor impulses in the area to which they are thus reflected. Dr. Woakes thus regards these sympathetic ganglia as so many stations on the lines traversed by vaso-motor impressions, in

which the points are managed, and by means of which impulses are transferred from one line to another. Widely separated tissue tracts are thus brought into a mutual relationship so intimate that it is impossible for any one of them to experience any change in the normal state of tone or vessel equilibrium without a corresponding change being *ipso facto* set on foot in the vascular supply of one or more of these remotely situated regions with which the vaso-motor fibrillæ of a given ganglion connect it.

Dr. Woakes goes on to say that the recognition of this physiological fact will assist to render intelligible a number of phenomena, observable in both health and disease. He illustrates this subject by quoting from Dr. Mitchel's studies of traumatic injuries involving the nerves. The latter states that many instances occurred during the late war where soldiers who received bullet wounds in the arm, axilla, or neck, *immediately fell to the ground;* an occurrence not observed in wounds of any other correspondingly non-vital part of the body. As this was not owing to loss of blood, the cause is explained thus: The inferior cervical ganglion possesses branches of communication with the two lower cords of the brachial plexus of nerves, and there are other channels of communication between the upper cords of this plexus and the vaso-motor nerves of the vertebral artery, also derived from the ganglia. Thus there exist direct lines for the interchange of impressions between the nerves of the arm and the remotest ramifications of the vertebral arteries. A small but important peripheral branch of the latter enters the internal auditory canal to supply the semicircular canals and labyrinth generally.

Dr. Woakes now draws the explanation of the above from this anatomical relationship: The shock communicated by the contusion of the bullet is transferred in the ganglion to the plexus on the vertebral artery in the form of a vessel-dilating impression to the ultimate branches of this artery, — there is a sudden accession of blood to the labyrinth, with corresponding increase of pressure on the endolymph, or fluid contained in the semicircular canals. The physiological interpretation is,

an interference with the equilibrating apparatus causes the sufferer to fall to the ground.

Any derangement of the stomach may, under certain conditions, cause an impression to be carried by a branch of the vagus from the stomach to the inferior cervical ganglion ; this impression is then transferred on a wave of vessel dilatation along the arterial trunks, whose innervation is mediated by the ganglion.

"The arteries in the area (affected) being dilated, offer less resistance than before to the passage of blood, consequently more blood than usual passes through them, filling up the capillaries and distending the veins."[1]

After quoting the above, Dr. Woakes observes that attacks which would otherwise be referred to obscure brain mischief may thus be imputed to functional derangement of a much less vital sub-centre, while the gravity of their meaning is proportionately lessened.

As regards noises in the head, Dr. Woakes presents a classification founded upon the anatomical and physiological relations which his language just quoted has established. This classification, moreover, includes conditions which have heretofore been well established, and may, therefore, be accepted as pretty well representing the present knowledge upon the subject. Dr. Woakes discards the term "subjective tinnitus," for the reason that the auditory nerve is incapable of originating any sound within itself ; and that for a sound to be heard it must have a prior existence in some abnormal conditions capable of giving rise to it.

His first class consists of labyrinthine congestions, either arterial or venous, the former causing pulsating, the latter rushing noises.

Secondly. Extra-aural anæmia and aneurisms, causing pulsating noises.

Thirdly. Fluid in the tympanum, or Eustachian tubes (catarrh of middle ear), producing bubbling and gurgling noises.

Fourthly. Congestion of membrana tympani, cavity of tym-

[1] *A Text Book of Physiology*, by M. Foster, M. D., 2d edition, page 170.

panum, or Eustachian tube, or all of them together (chronic non-suppurative inflammation of ear), causing tidal noises.

Fifthly. Undue contraction of intrinsic muscles (reflex irritation of tensor tympani nerve from otic ganglia), producing similar noises to above.

From what has been previously stated, the first class enumerated here will be well understood to include the symptoms of giddiness, headache, etc., which are usually grouped under the name of Ménière's disease.

The treatment which Dr. Woakes has found most efficacious in the class of labyrinthine affections, consists of the use of hydrobromic acid, in fifteen minim doses, repeated every four hours, which is administered with a view of increasing the inhibition of the vaso-motor centre constituted by the ganglion (inferior cervical), referred to previously. Dr. Woakes regards the action of hydrobromic acid as specific in these cases, and as antagonistic to quinine. The latter drug he believes capable of suspending the inhibitory action in the vaso-motor centre over which the inferior cervical ganglion exercises control.

By this announcement we are brought to face an important departure in therapeutics. Physiologically, says Dr. Woakes, we are guided to the corollary, that distinct vaso-motor areas exist in the animal body, and that changes may take place in the circulation of such areas which are purely local in the first instance; that such changes are equivalent to local hyperæmias, or anæmias, according as the vaso-motor influences of the area are suspended or added to; and one or another of these conditions affords the clew to a vast number of pathological states; and, further, that any true system of therapeutics must be based on the recognition of the principles now enunciated.

In connection with the foregoing I recall an interview with Dr. Piffard, who had occasion to see me about his own case, before the article of Dr. Woakes came under my notice. The doctor had previously had attacks of subacute inflammation of the middle ear. He informed me that he had frequently noticed tinnitus in his own person when at stool, but not at

other times, the tinnitus being increased by efforts at straining. He had, therefore, surmised that the tinnitus was (in his case) due to congestion of some part of the auditory apparatus, and that congestion, temporary or chronic, might, therefore be the causative agent in the production of tinnitus in other cases. As the noise that Dr. Piffard experienced was similar in character to that produced by quinine, he suggested that hydrobromic acid being a physiological antidote to quinine, so far as the ear is concerned, might prove useful in the treatment of certain cases, and the quinine itself would probably benefit such as were of an opposite character, the quinine not being given for its supposed tonic properties, but on account of its specific relationship to the parts involved.[1]

Opportunity offering, I tried the hydrobromic acid, with good results in a typical case of reflex auditory vertigo.

BOOKS.

During the past year the work of Dr. Charles H. Burnett, entitled a "Treatise on the Ear," has been published. The labor which the author has bestowed upon the entire work has been very great.

It is seldom that the practical physician has the opportunity as well as ability to perform a labor of this magnitude.

The "Treatise on the Ear," by Professor Roosa, which has gained an international reputation since its appearance, is now being prepared by its author for a fourth edition, by a careful revision of the chapter on diseases of the inner ear. Professor Roosa has prepared this chapter with great care, bringing it up to the level of the present state of science on this subject. In doing this Professor Roosa has brought forward his own recent researches, together with the numerous contributions to the subject by others.

It is scarcely necessary to add here that since Professor

[1] In this connection it is due to Dr. Samuel Theobald of Baltimore, to state that as early as April, 1875, he called attention to the vascular theory of tinnitus aurium in a paper read before the Medical and Chirurgical Faculty of Maryland. Dr. Theobald deserves the credit of having directed attention at that time to what he modestly claims to be a step in the right direction.

Roosa's third edition, most of the advances in otology have been in relation to the inner ear.

Professor Schwartze of Halle, has prepared a volume on the "Pathological Anatomy of the Ear." It appears as a contribution to "Kleb's Handbuch der Pathologischen Anatomie," and is published in Berlin. The English translation, by Dr. J. Orne Green of Boston, will render it accessible to all. The value of a clearly wrought monograph like this one is very great, and doubtless hereafter the work of otologists will be found to be more useful when fewer publications shall be prepared with the intent of covering the entire field of otology.

Dr. Green, by the faithful translation of this work, has placed the English portion of our profession under deep obligations, for Professor Schwartze's work is one which every studious physician will desire to possess, whether he be specialist or general practitioner. The work of translation could not have fallen into more competent hands, for Dr. Green has especially fitted himself for the task by his own researches in the field of aural pathology, his contributions being well known to, and highly valued by aurists everywhere. No one less thoroughly imbued with the importance of Professor Schwartze's labors could have done justice to a work of this kind.

In the preface to the translation, Dr. Green thus refers to the work: "Schwartze's 'Pathological Anatomy of the Ear' constitutes the sixth part of 'Kleb's Hand-book of Pathological Anatomy.' It is the only comprehensive work strictly devoted to the pathological anatomy of this organ, and on account of the opportunities and devotion of the author in this special field, his well-known thoroughness and strict impartiality in scientific researches, it is a most valuable addition to the literature of otology. It is essentially a hand-book on the subject of which it treats, a small amount of space often sufficing to give the results of researches, the laboriousness of which can only be appreciated by those who have been engaged in similar work."

From the merits of the translation, which can only be re-

ferred to in terms of praise, we must turn to the book itself. Dr. Schwartze here seems to have gone over the field in the most exhaustive manner, which is, perhaps, saying all that can be said of a treatise which professes to be a complete monograph of this particular part of pathology, especially, if coupled with the assertion that no man is more competent for the work in hand.

In the introductory chapter, an account of the literature of the subject begins with Duverney, "Traité de l'Organe de l'Ouie," Paris, 1683; and it includes pretty much everything relating to the subject down to the date of writing.

In referring to the founders of the pathological anatomy of the ear, he of course places the English aurist, Joseph Toynbee, at the head of the list, not, however, neglecting to mention the later works of his countrymen. For the further development of the subject we are mostly indebted, the author says, to the German physicians of the present day. In concluding the introduction, directions are given for the dissection of the ear, Professor Lucae's method being adopted. For the examination of the inner ear, Schwartze gives us his own method of procedure.

The subject matter of the book is well arranged, the division of subjects being as follows: Temporal Bone in General; The Auricle; The External Meatus; The Drum Membrane; The Tympanum; The Eustachian Tube; The Mastoid Process, and Inner Ear and Auditory Nerve.

The concise style of the author has enabled him to embrace, in the space of one hundred and seventy-four pages, the results of the labor of a life; and no review could explain the text better than extracts from the book itself, which of course would be out of place here.

Not the least valuable part of the book is embraced in the appended literature of subjects and the foot-notes of reference; these alone are invaluable, and nowhere else can so rich a store of such information be found. One is struck here, however, by the almost entire absence of allusion to the pathological contributions of our own countrymen, which are, I am sure, not entirely devoid of value to the aural pathologist.

The illustrations are from the original wood engravings, and compare favorably throughout with those in the German edition, which we have compared them with; indeed, owing to the superior quality of paper used by the American publishers, many of the numerous illustrations are superior to the German.

A "Practical Treatise on Aural Surgery," by H. Macnaughton Jones of Cork, has been published this year. It seems to be one of the class of works just referred to as unnecessary. A reviewer in the "American Journal of Medical Sciences," for July, 1878, says of this book: "It is, in fact, impossible to see wherein otology or general surgery can be benefitted by such a book."

INDEX TO PART II.

Dalby, W. B. Contributions to Aural Surgery. "Lancet," 1876 and 1877.

Report of the First Congress of the International Otological Society. New York, 1876.

Hughlings-Jackson, J. Nervous Symptoms with Ear Disease. "Med. Times and Gaz.," March 24, 1877.

Gowers, W. R. Diagnosis of And. Nerve Vertigo. "British Med. Journal," March 10 and April 21, 1877.

Cumberbatch, A. E. Paracentesis of Memb. Tym., for Mucous Accumulations in Tympanum. "Saint Bartholomew's Hospital Reports," 1876.

Urbantschitsch. "Wiener Med. Wochenschrift," November 23, 1876.

Dreyfus-Brissac. "Annales des Maladies de l'Oreille du Larynx," May, 1877.

Lévi. Étude Historique et Critique sur la Cathétérisme de la Trompe d'Eustache et les divers Procédés en Usage pour faire pénétrer de l'air comprimé dans l'Oreille Moyenne. "Annales des Maladies de l'Oreille du Larynx," 1877.

Cooper, Robert S. On the Removal of Foreign Bodies from the Ear. "The Dublin Journal of Med. Sciences," April, 1877.

Cassells, James Patterson. Shut your Mouth and Save your Life. "Edinburgh Med. Journal," February, 1877.

Cassells, James Patterson. Ear Diseases and Life Insurance. "British Med. Journal," March 17, 1877.

Moos. "Virchow's Archiv für Pathologische Anatomie und Physiologie," vol. lxviii.

Grüber. "Allgem. Wiener Mediz. Zeitung," No. 7, 1877.

Williams. "Lancet," April 22, 1877.

Smith, Hanbury. Thirteenth Annual Report of the State Lunatic Asylum at Columbus, Ohio, 1851.

Jones, H. Macnaughton. Practical Remarks on Aural Affections. "The Med. Press and Circular," 1877.

Field, George P. The Graver Aspects of Otorrhœa. "Med. Press and Circular," June 6, 1877.

Trautmann. "Berliner Klinische Wochenschrift," February 9, 1877.

Wagstaffe. "British Med. Journal," December 23, 1877.

Pinkney, Howard. "New York Med. Journal," September, 1874.

Ladréit de Lacharrière. "Annales des Maladies de l'Oreille du Larynx," July, 1876.

Hardy. "Paris Médical," April 13, 1876.

Woakes. Paper read before British Med. Society, London, January 29, 1877.

Nothnagel and Huguein. "Cyclopædia of the Practice of Med." Ziemssen. Vol. xii. Edited by Albert H. Buck. Wm. Wood & Co. New York. 1877.

Green, J. Orne. "Disease of the Brain in its Relation to Inflammations of the Ear," pp. 26, Boston, 1877.

Roosa, D. B. St. John. "Med. Record," New York, 1877.

Buck, Albert H. "Medical Record," New York, No. 333. 1877.

Shaw. The Injurious Effects of the Nasal Douche, etc. "Boston Med. and Surgical Journal," 1876.

Paulson. "Monatschrift für Ohrenheilkunde," No. 2, 1876.

Blake, Clarence J. "Archives of Clinical Surgery," New York, June 15, 1877.

Agnew, C. R. "American Clinical Lectures," vol. i., Putnams, New York, 1875.

Burnett, Swan M. A Case of Diplacusis Binauralis. "Archives Ophth. and Otol.," New York, 1876.

Michel, J. On the Use of Nitrate Amyl in Diseases of the Ear. Translated by Clarence J. Blake. "Archives Ophth. and Otol.," New York, 1878.

Spencer, H. N. Nitrite of Amyl in Diseases of the Ear. "St. Louis Medical and Surgical Journal," June, 1877.

Moos, S. The Histological Changes of the Eustachian Tube in Chronic Catarrh. Translated by A. N. Blodgett. "Archives Ophthalmology and Otology," New York, 1876.

Hall, L. Brewer. Aspergillus in the Ear. "The American Jour. of Med. Sciences," April, 1877.

Roosa, D. B. St. John. The Disproportion between the Power of Hearing the Tick of a Watch and the Human Voice; with Remarks on Hearing Better in the Midst of a Noise. "The American Jour. of Med. Sciences," January, 1877.

Blake, Clarence J. Manometric Cicatrix of the Membrana Tympani. "Archives Ophth. and Otol.," New York, 1876.

ACUPUNCTURE AND DRAINAGE IN THE TREATMENT OF SEROUS EFFUSION INTO THE TYMPANIC CAVITY.

BY CLARENCE J. BLAKE, M. D., BOSTON.

CASES of serous accumulation in the middle ear usually fall under one of two classes: those in which the fluid has accumulated in consequence of a closure of the Eustachian tube, without congestion of the tympanic mucous membrane, and those which present more decidedly the symptoms of an acute inflammation of the middle ear in its earlier stages.

In the first class of cases we have to deal usually with an inflammation of the naso-pharyngeal mucous membrane which has extended to the lining of the Eustachian tube, resulting in a degree of swelling sufficient to close that passage, and a degree of congestion sufficient to cause the exudation of serum, which, unable to escape into the pharynx, finds its way into the tympanic cavity, causing various subjective symptoms characteristic of middle-ear inflammation. Objectively. however, the symptoms of acute middle-ear trouble are usually wanting; the membrana tympani is transparent, without congestion; through the yellowish fluid within the middle ear the descending process of the incus and the inner tympanic wall may often be distinctly seen; the dark line which marks the level of the fluid may be distinguishable or the fluid may fill the cavity so completely as to extend above the periphery of the membrana tympani. The presence of the fluid is therefore, so to speak, merely mechanical; it is a secondary and accidental symptom. So long as there is no undue pressure from the presence of the fluid in the middle ear the existing condition may persist without other untoward symptoms than the sense of fullness, tinnitus aurium, and diminution of hearing, until a relief of the pharyngeal trouble frees the Eustachian tube and allows the fluid to pass into the pharynx. If, however, the fluid unduly accumulates, its pressure becomes a

source of irritation, and the more acute symptoms of middle-ear inflammation begin to show themselves.

In the second class of cases the serous accumulation occurs in the earlier stage of an acute inflammation of the middle ear, originating either independently or in consequence of pharyngitis. In these cases the fluid usually accumulates more rapidly, and its presence is accompanied by both subjective and objective symptoms of congestion and inflammation of the tympanic mucous membrane which call for more immediate relief.

Paracentesis of the membrana tympani, which is usually recommended in both of these classes of cases, is in some of them open to certain objections. In cases of accumulation of serous fluid without symptoms of acute inflammation in the middle ear itself, paracentesis is merely the treatment of a result, which, while it gives relief from the annoying deafness and the accompanying subjective symptoms, does not tend to remedy the primary cause of the trouble, and may cause sufficient irritation to precipitate the acute middle-ear disease which it is desirable to avoid. This result may be brought about in two ways; either as a direct result of the irritation consequent upon the operation, or because the delicate outer coat of the membrana tympani, unlike the mucous lining of the tympanic cavity, which readily tolerates the presence of a serous fluid, is macerated by the fluid poured out through the opening made, and becomes the seat of an inflammatory process. Although the immediate results of the paracentesis in these cases may be very gratifying, it is to be found as a rule that the ultimate results of treatment of the naso-pharyngeal and tubal affection alone, however tedious this may seem, are very much better.

In the earlier stages of acute inflammation of the middle ear, where there is serous accumulation with congestion of the blood-vessels of the mucous membrane, and a sufficient degree of pressure to cause a bulging outward of the membrana tympani, paracentesis and a free evacuation would seem to be strongly indicated; but even here such a procedure lavishly

indulged in, while it gives immediate relief, may be the cause of future and prolonged trouble.

To the already congested tissues the free incision comes as a fresh source of irritation, and the free evacuation of the fluid and its unrestricted flow have two results; the sudden and entire relief of the intra-tympanic pressure favors a rapid dilatation of the blood-vessels and copious serous effusion; this fluid allowed to flow from the incision at will bathes the outer surface of the membrana tympani and the lining of the inner end of the external auditory canal, macerating the epidermis and favoring an extension of the inflammatory process.

These two possible, by no means inevitable results may be avoided in a measure by gradually relieving the intra-tympanic pressure without cutting the membrana tympani, and by absorbing the fluid as it exudes into the external auditory canal.

The first object is accomplished by substituting a fine needle or a group of from two to four needles for the paracentesis knife; the second, by lightly packing the inner end of the canal with dry absorbent cotton, which should be carefully renewed so soon as it becomes saturated.

In several cases which have recently come under my observation, and of which the notes will be subsequently published, this treatment has been followed by excellent results. There has been a greater or less immediate relief from the subjective symptoms; less marked, it is true, but with speedier complete recovery than in similar cases treated by free paracentesis.

In the second class of cases, where the degree of intra-tympanic pressure and the coincident inflammatory symptoms demand the performance of paracentesis, it becomes important to shield the lining of the inner end of the external auditory canal from the macerating effects of the exuded fluid by establishing a drainage which shall carry and deliver the fluid at the outer end of the canal, leaving the deeper seated portion comparatively dry. This may be easily accomplished by making a roll of dry absorbent cotton four or five centimeters long, one end of which shall be small enough to be passed into the opening

in the membrana tympani, the larger and looser end projecting from the meatus. Experience shows the presence of such a roll of cotton to be well tolerated and while absorbing the fluid with sufficient rapidity it prevents the sudden and complete evacuation of the cavity.[1]

A drainage wick of this sort should at first be frequently removed, but as the excessive exudation diminishes it may be allowed to remain certainly twenty-four hours, and often longer, without causing inconvenience.

COAGULATED FIBRIN SIMULATING POLYPUS OF THE TYMPANUM.

BY J. ORNE GREEN, M. D., BOSTON.

A HEALTHY man, aged seventy-three years, both of whose ears had been seriously injured years before by frequent inflammations, which had produced great thickening of the tympanic mucous membrane and rigidity of the conducting apparatus with consequent deafness, began to suffer from severe pain in the left ear just after scratching the meatus with a pin. This pain continued with violent throbbing for twelve hours, and was then much relieved by the discharge of a thin serous fluid. At this time I saw him, and found an acute inflammation of the tympanum with a small perforation of the drum-membrane. Douching and warm instillations were ordered, and the further history was simply that of a moderately severe tympanic inflammation, except in regard to the character of the discharge. The next day the discharge was thin, slightly yellow serum, but examination showed the meatus, which was perfectly free the day before, to be filled with a red

[1] Of the various forms of absorbent cotton that which I have found to best answer the purpose is prepared by Dennison & Co., Boston. As an evidence of its value as an absorbent, Dr. Agnew demonstrated at the meeting of the society that a roll of this cotton 5 centimeters long and about 4 millimeters in thickness, lightly rolled, used as a siphon, delivered 14 minims of water in the minute.

mass, freely movable, and attached by a small pedicle to the seat of perforation; it exactly resembled a smooth polypus. This was seized with the forceps and easily torn away without any sensation to the patient.

Under the microscope the mass showed a net-work of finely granular fibrillæ intermixed with occasional blood corpuscles, and was evidently coagulated fibrin colored red by the intermixture of the blood corpuscles.

On the third day of the inflammation another smaller mass had coagulated at the same spot, and was removed; the serous discharge continued, and the typanum appeared to be nearly filled with coagulum, judging from its color and firm feeling when touched with the probe. On the fourth day scarcely any coagulum was found externally, the mass within having apparently nearly closed the opening. The next day all discharge had ceased, and in two days more the perforation had closed by contraction of its edges. No pain was felt after the first day, and there were no subjective noises or other symptoms. The hearing on that side, which previously had been for the watch $\frac{3}{60}$, was reduced by the inflammation to contact.

From the firm character of the coagulated fibrin, its tendency to become organized and to contract, from the fact that in all probability the whole conducting apparatus of the tympanum was imbedded in it, and from the deformed condition of the ear owing to previous inflammation, my prognosis for the hearing was very unfavorable; but on examining the patient after a month's interval the whole tympanum had become clear, and there was no change either in appearance or in hearing from what had existed before the inflammation, the test with the watch giving $\frac{3}{60}$.

Throughout the whole course of the inflammation the epidermis of the membrana tympani and meatus remained unbroken, there were no constitutional symptoms, and the only peculiarity of the case was that the exudation, instead of being thin serum or mucus, was so rich in fibrin that it coagulated firmly on exposure to the air.

It is a marked instance of the close relationship of the lining membrane of the tympanum under pathological conditions to the serous membranes.

COMPLETE OCCLUSION OF THE EXTERNAL AUDITORY CANAL BY A DERMOID MEMBRANE; AN EVIDENCE OF HORIZONTAL MOTION OUTWARD IN THE EPIDERMIS OF THE CANAL.

BY ALBERT H. BUCK, M. D., NEW YORK.

Mrs. S., aged 50, consulted me in the summer of 1876 for deafness of slight degree, referable chiefly to the left ear, and of about one year's duration. Examination with the speculum and reflected light revealed the following condition of things in the left ear: In the osseous portion of the external auditory canal, at a point about one third of an inch from the drum membrane, a membranous structure completely occluded the canal. To the eye this membrane presented all the appearances of ordinary cuticle. At no point did it afford the slightest evidence of being provided with blood-vessels. When touched with the probe it yielded to the pressure in precisely the same elastic manner as would any thin membrane like the cuticle when separated from its underlying connections. The peripheral portion of the membrane was carefully tested with the probe at all points of the circumference, for the purpose of ascertaining the nature of its attachment to the skin of the external auditory canal. At every point it was found to be continuous with the cuticle of the neighboring skin. The plane of the membrane was nearly at right angles to the axis of the canal. A crucial incision was made, and the fragments of the membrane were in part removed by the forceps, in part left undisturbed. At the points where the attached fragments of membrane had been torn off, no evidence of any line of attachment remained, beyond at most a diffuse redness of the skin.

The drum membrane beyond presented a fairly normal appearance, and the hearing was somewhat improved by the removal of the obstacle.

This case, which is entirely different in its pathogenesis from the one which I reported in 1874,[1] derives its chief importance from the light which it throws upon the question of horizontal or surface motion in the epidermis of the membrana tympani and skin of the external auditory canal. That such a motion exists on the outer surface of the drum membrane has been known for several years. Every aural surgeon who has had occasion to perform paracentesis of the membrana tympani has observed how from day to day the scab resulting from his incision moves from its original situation in the posterior half of the membrane, midway beween the umbo and the periphery, toward the latter, and eventually, in its outward course, leaves the drum membrane entirely. The same motion has been observed in the external auditory canal in the immediate vicinity of the membrana tympani. Dr. Burnett, in his "Treatise on the Ear" (p. 46), speaks of this outward movement of the skin of the external auditory canal as affording an explanation of the way in which the superabundant cerumen is extruded from the canal. This surface movement, then, of the epidermis of the drum membrane and external auditory canal furnishes, I believe, an explanation of the presence — in the case narrated above — of a cuticle-like, membranous diaphragm in the outer canal of the ear. This membrane, according to this theory, would represent a desquamation — probably the result of an acute congestion of the parts — of the entire epidermal coat of the drum membrane. That part of the cuticle of the membrana tympani which had separated from the underlying living epithelial cells must, in the present instance, have retained (at all points of the circumference) its connections with the neighboring healthy cuticle of the external auditory canal. The surface motion known to

[1] *Transactions of the American Otological Society*, Case III., in article entitled, "Ultimate Forms of Granulation Tissue in the Ear."

exist in the cuticle of the deeper portion of the canal extends without doubt throughout the entire canal. Hence, in the present case, after separation of the cuticle had taken place on the drum membrane, the centrifugal motion of the remoter parts of the separated membrane — due to the traction exerted by the outwardly moving healthy cuticle of the external auditory canal — must have produced at first merely a state of tension (equilibrium) in the central portions of the cuticular membrane. At a later moment, however, this outward motion of the healthy cuticle must have exerted a symmetrical outward traction upon the cuticular membrane, eventually lifting it completely off the underlying membrana tympani. That in this particular case a rupture did not occur at some point must be ascribed simply to the fact that probably all things conspired to favor a separation of the desquamated cuticle in its entirety. After the act of separation had once taken place, there was no reason why the separated cuticle (now an independent diaphragm) should not remain unbroken, until acted upon by some force from without. If different parts of the healthy cuticle of the external auditory canal traveled outward at different rates of speed, we might look for a rupture, or at least for a distorted cuticular diaphragm. The flatness of the membrane, in the present case, and the inclination of the plane which it occupied, would rather favor the view that the rate of speed is the same for all parts of the canal.

Further observations and experimental researches will doubtless soon determine accurately all the facts connected with this peculiar horizontal cuticular motion, analogous to the growth of the nail, which may be looked upon as a cuticular structure.

A CASE OF MYXOFIBROMA OF THE AURICLE.

BY C. R. AGNEW, M. D., NEW YORK.

C. S., aged 11, of Virginia, received a scratch from a toilet pin, at the age of two years, upon his left auricle. The scar soon developed into a distinct tumor, and at the end of eighteen months, being of the size of a buckshot, was removed by the knife.

Almost immediately it returned in the place of the scar, but was not removed until at the end of about two years, when it was carefully dissected from the cartilage, and found to be about three times the size of the original growth. The wound was touched with pure carbolic acid, and allowed to heal by granulation. Again the growth returned, and, having attained the size of double that of the second tumor, was, after the lapse of two years, removed; but on this occasion, as upon the previous ones, in such a manner as to include in the dissection as little as possible of the surrounding tissue.

On December 19, 1877, the case came under my care, through the favor of Dr. J. M. Smith, of Gordonsville, Va., and presented the external physical features delineated in the accompanying illustration, taken from the tumor immediately after removal. After consultation with Dr. William H. Van Buren I removed the tumor, and with it nearly all the cartilage of the auricle down to the bony rim of the external auditory canal, leaving the pendent lobule and skin enough to make a projection somewhat resembling a small auricle. I found that the scissors were better than the knife for separating the skin from the cartilage, and cutting away the cartilage itself. After removing the mass with a margin of apparently healthy skin half an inch in breadth, and all the cartilage at all involved in it as well as contiguous to it, we brought the edges of the wound accurately together, retaining them by very numerous interrupted sutures of the finest silk, and completed the dressing with a large mass of dry charpie and a flannel band-

age. The lad went to Virginia on the evening of the same day, and the wound healed by primary adhesion throughout.

In June, 1878, again the tumor began to recur, showing a small nodule in the lower end of the scar near the lobule, while the other part of the line of healing remained quite healthy. Immediate removal was again advised. Whether the advice has been carried into effect we have not yet heard.

Dr. C. Heitzmann, of New York, to whose kindness I am indebted for a careful microscopic examination and drawing, reports the tumor to be a myxofibroma.

I do not report the case because tumors of the class are rarities, but because some of its features may be sufficiently peculiar to merit attention.

THE RELATIONS OF THE CONDUCTING MECHANISM OF THE EAR TO ABNORMAL HEARING.

BY SAMUEL SEXTON, M. D., NEW YORK.

An attempt to solve some of the remaining mysteries of audition will, it is hoped, be received with patience by otologists, and it may be premised that as physiological researches upon this subject have taken the lead of all others, our views have been, to a great extent, founded upon their theories. Some of the conclusions arrived at by physiologists concerning the functions of the inner ear are truly remarkable when the paucity of facts at their command is considered; and their acceptance by aurists has had, perhaps, too great an influence upon their investigations, inducing them to adapt the teachings of pathology to these plausible theories; and it is to be feared they have been only too willing to refer the unexplained workings of the mechanism of the middle ear to the labyrinthine realms of the inner ear. Fortunately for otology, the physicist has not been able to warp his researches in acoustics

to suit any *theory*, however much he may have been diverted from his scientific pursuits in this direction by the doctrines of physiologists. Pathological observations have long seemed to lead to the conclusion that many abnormities, hitherto regarded as lesions of the inner ear, could be explained by recognizable changes in the domain of the middle ear; and, in order to make myself clearly understood on this subject, I shall endeavor to group my remarks under three divisions, namely, Phonation, Conduction, and Perception, although in referring to audition, in general, it will not be easy to so restrict the subject.

PHONATION. — Although all sound concerns hearing, the relations of phonation to it are the most intimate.

The vocal chords, which are contained in a cartilaginous apparatus composed of the thyroid and cricoid cartilages and supported by the windpipe, are most favorably situated for imparting their vibrations not only to the air in the throat, mouth, etc., but also to the tissues of the neck which surround them. The position of this musical box upon the windpipe doubtless improves the sonorousness of its vibrations.

The vibrations from the vocal chords reach the ear by two distinct routes: one being to the mouth cavity, and thence through the ambient air to the external meatus; the other route being through the tissues of the neck and head, — muscle, bone, etc., — to the drum, the directness of their course depending upon the conductivity of the various tissues which intervene. The vibrations by the latter route are not heard in the normal condition of the ear, at least not as distinguishable from the former. In some instances the sound waves pass from the mouth to the drum, by aerial conduction through the Eustachian tube, as I have demonstrated by means of the diagnostic tube passing from the patient's ear to mine; this state of things, however, is rare. We have here to do mostly with the sound which reaches the ear through the tissues, and in order to appreciate their importance it is well to consider for a moment their behavior. This is best illustrated by that wonderful invention of Edison's, the talking machine. It is

well known that the ability to talk remains to those who have lost what were considered most important portions of the organs used in speech, namely, the tongue, nose, epiglottis, etc.; but the simple nature of the essentials to voice was left to the phonograph for elucidation. It shows that perfectly intelligible voice can be produced without the aid of the mouth, nose, etc.; although they were instrumental in forming the words recorded, the instrument emitted them again without their assistance. By the aid of the phonograph and telephone, Jenken and Ewing have shown that the vowel sounds do not, as Helmholtz thought, depend upon notes of absolutely definite pitch. The pitch of these sounds as spoken by the phonograph varies with the rapidity with which its cylinder revolves, but *character* is maintained, however rapidly the words may be spoken by the machine.

Observation has shown that the vibrations of the vocal chords reach the ear with the same constancy through the tissues as by the mouth and ambient air. *Persons absolutely deaf to external sounds still hear their own voice.* In order to determine whether the mouth, nose, etc., had any influence in forming the voice heard under these circumstances, I had a suitable trumpet constructed which conveyed my own voice into the mouth of the deaf person. The result was, when I spoke distinctly into the mouth, *noise* was heard plainly, but he could not distinguish one word from another, excepting as to pitch. It is therefore evident that voice can reach the auditory nerve without receiving the aid of the mouth, etc.

The weight of evidence, I believe, is now against the theory that in man the Eustachian tubes are capable of permitting aerial conduction from the mouth to the ear, when in a normal condition. This was the belief of Schelhammer,[1] and J. Muller coincided partially with him.[2] (Cited by Rouis.)

The mouth trumpet, however, when used by me in cases where deafness was very great, conveyed voice to the ear as well, and in some instances better, than the ear trumpet. This

[1] *De Auditu, Leyde*, 1784. [2] Loc. cit., t. 11, page 432.

may be accounted for by the fact that mouth reception permitted vibrations to reach both ears at the same moment.[1]

Conduction of Sound. — Before considering the anomalies of conduction it will be well to take a brief view of some established points in normal conduction. The extreme fineness of the membrana tympani is the first thing to attract attention ; it is only 0.1 millimeter in thickness, and is capable of transmitting from 16 to 40,000 vibrations a second to the auditory nerve. This delicate movement of the membrane is equaled by that of the stapes in the oval window, whose excursions in the fainter, but still distinguishable tones, are so small as to escape detection with the highest powers of the microscope.[2] (Reimann.) Keeping these facts of audition in view, we may here state that Edward Weber regards the bones of the ear and the petrous portion of the temporal bone as solid, incompressible bodies, and the fluid of the labyrinth as an incompressible fluid ; and the bones of the ear must be considered as solid levers which transmit waves of condensation and rarefaction to the fluid of the labyrinth, moving it as a whole.[3]

The description of some of the movements of the conducting mechanism, in Helmholtz's own words, will make the allusions further on more readily understood. Helmholtz says :[4] "The joint between hammer and anvil admits of a slight rotation about an axis drawn transversely through the head of the hammer toward the end of the short process of the anvil ; a pair of cogs oppose the rotation of the manubrium inward, *but it can be driven outward without carrying the anvil with it ;*"[5] and "with a joint of this nature a *slight displacement*[5] must necessarily take place between the hammer and anvil whenever the end of the handle of the hammer is driven in-

[1] The subject of "Transmission of Vocal Sounds by the Eustachian Tube" is discussed in *Recherches sur la Transmission du Son dans l'Oreille Humaine*, par J. L. Rouis, S. M. P., Médecin Principal d'Armée, etc., Paris, 1877.

[2] Helmholtz, translated by Buck and Smith. New York, 1873.

[3] Loc. cit., page 9.

[4] Loc. cit., pages 33, 38, 44, 48.

[5] The italics are the present writer's.

ward." . . . . "By means of an increase of pressure in the cavity of the drum or diminution of pressure in the meatus, the membrana tympani can be perceptibly driven outward without the stirrup incurring the danger of being torn from the fenestra ovalis." The membrana tympani serves as a powerful resistant to the reverse movement of the hammer. As regards the further action of the mechanism, Helmholtz says: "The excursion which the hammer can make without the anvil is nearly nine times as great as that which the two together can accomplish. *This kind of movement is not transmitted to the water of the labyrinth*,[1] excepting of course the slight changes in pressure which the changed tension of the articular ligaments, or the rubbing of the articular surfaces of the malleo-incudal joint upon one another, is perhaps capable of producing in the water of the labyrinth when the cogs of the articulation are no longer in contact."

From the above it is seen that in health a very free motion or a separation takes place in the malleo-incudal joint, and when this separation has been further increased by pathological changes, there may occur the symptoms of autophony, tinnitus, etc. The anomalies which induce these changes in the delicate mechanism described are principally as follows: Hyperæmia and inflammation of the drum, and their results, namely: anomalies of tension of the drum membrane; pathological changes of the ossicles and their articulations; pathological changes in the tympanic muscles.[2]

Probably the most frequent change in the membrana tympani is thinning of its layers from the atrophy occasioned by hyperæmia, a condition which is permanent. (Described by Stifler, of Munich.) Stretching is not unusual in this condition.

Temporary alterations of the membrane, as regards thickening and tension, are caused by acute and chronic inflammations, and the presence of fluids in the cavity may further increase the abnormities of tension.

[1] The italics are the present writer's.

[2] For a complete description of the pathological anatomy of the ear, consult Schwartze, translated by J. Orne Green. Boston, 1878.

The ossicles and their articulations and the tympanic muscles are more or less affected by the same causes. The transmission of sound is also affected by anomalies of the membrane from thickening, calcification, cicatricial changes, severe concussions, attended with inflammation, hyperæmia, or rupture of the membrana tympani, such as are produced by the hammering of metals, by sounding of steam-whistles, discharge of explosives, artillery, small arms near the ear, and the like, blows upon the ear, violent entrance of foreign bodies wounding the middle ear, impacted collections of cerumen, etc.

It is very difficult to elicit an intelligible account of their symptoms from patients who are the subjects of the abnormities we are about to enumerate as arising from these causes. This is owing to their inability to describe acoustical phenomena, of which they usually have but little knowledge. Musically educated persons are greatly confused under these circumstances, as will appear further on.

I have found these symptoms prevailing in a much larger number of patients than was suspected before my attention was specially directed to this subject, and before particular efforts were made to obtain an account of symptoms under such difficulties. Where the symptoms are very marked the patient usually describes them as follows: hearing double; hearing an echo or reverberation in one or both ears, when phonation is performed; hearing own voice as distant, slow, down in a well or pit; hearing own voice as though speaking in an empty vessel; hearing own voice as muffled. Others describe their own voice as "going out of the ear from within;" some describe the sensation as a "feeling of the head being empty." When a person of inferior mind is closely pressed for a description of these anomalies of hearing, he confesses his inability to do the subject justice, and very likely asks if his speech does not explain itself. In fact, most patients have the belief that others hear their voice as they hear it themselves, *i. e.*, abnormally.

Musical people, when affected with autophony, not hearing their own voice naturally, are unable to sing correctly; they fancy that others do not sing in tune. It is difficult to convince

them that they can hear musical instruments correctly; but when they give the matter close attention it is found that they can hear external sounds correctly, although in some cases with difficulty, owing to the deafness to all external sounds, from interference. It has been found to be a good plan to request the patient to whistle, which is not an effort of phonation, and can therefore be heard by him externally.

The ignorant and superstitious are sometimes haunted by dreadful imaginings and foreboding of impending evil.

While seeking an explanation of these symptoms my attention was directed, in June, 1874, by a clergyman who was under my care, to the fact *that he could hear his watch tick only when he laid one ear over it.*

This was at the time inexplicable to me, and the only cause for its occurrence seemed to be some condition of the inner ear which was affected by the position of the patient's head; but many observations failed to throw any light on the subject. In September, 1876, by another case[1] my attention was first directed to the conducting apparatus as the true source of these abnormities.

This patient, while under my treatment for deafness arising from a subacute inflammation of the middle ear, found that *when he immersed his head under water, in diving, his hearing instantly returned*, although he became deaf again shortly afterwards. Subsequent observations have confirmed my suspicions as regards these conditions, and when the anatomy of the conducting mechanism is considered, together with its extreme delicacy, we can readily see that slight pathological changes are capable of producing the symptoms of autophony, tinnitus, etc.

Autophony does not occur, so far as I know, when the membrana tympani is absent; and furthermore, *the existence of a perforation does not prevent its occurrence, provided the ossicles and their attachments are not thereby affected.*

Total deafness to external sounds in both ears prevents, of course, the occurrence of double hearing, as the patient then

[1] See report of case in *New York Medical Record*, January 13, 1877.

cannot compare the hearing of his own voice, transmitted from the vocal chords through the tissues, with his voice as received through the external meatus. Patients affected with double hearing speak in their usual tone of voice with great difficulty, since they do not hear it as coming from the outside, and, fancying others cannot hear them correctly, are prone to elevate their voice accordingly.

Double hearing, as will be explained hereafter, is, in a certain number of cases, variable, and the person so affected will change his voice during conversation or reading aloud every time his own hearing is altered. This usually distresses patients very much, and is equally unaccountable to the auditor.

While writing this article I have been visited by a patient who has the peculiarity of hearing double, "like speaking into an empty vessel," when he is up and about, but the moment he lies down the abnormity disappears; when he rises from any reclining posture the double hearing returns with a snap, owing to the friction of the malleo-incudal joint. In my note-books are the records of several cases, persons long subject to this symptom, where *normal hearing is restored by pulling the auricle in an outward direction. Sometimes the same result is accomplished by swallowing or yawning.*

Hearing the ticking of a watch, and not hearing ordinary conversation (and the contrary), and hearing better or worse in a noise are explainable by the condition of the malleo-incudal joint or membrana tympani, or both. Burnett relates a case where a young lady *heard all sounds normally with the exception of thunder*, the low rumblings of which she could not hear at all.[1] Mr. D. Greenberger, Principal of the Institution for the Improved Instruction of Deaf Mutes, New York, informs me that during the prevalence of a thunder-storm *many of the deaf mutes in the institution cry with the pain produced by the low concussions.*

A patient now under treatment for absolute deafness for the voice, was standing upon the battery when the sunset gun

[1] *Transactions of the American Otological Society*, vol. i., p. 106.

was fired at Fort Hamilton, about one mile distant. The unexpected concussion almost prostrated him, and he did not recover from the actual pain in one of his ears for some hours; the parts in the neighborhood of the ear were tender to the touch for a day or two. A word spoken in a very low tone, or a whisper directly in the concha of this patient, is painful, whereas high notes uttered a few feet distant are heard without pain, if heard at all. All sounds heard have a high pitch. My bass voice at its greatest intensity has a sharp, high sound to him. This, however, is not the case with his own ordinary voice through tissues of neck, etc., which is heard as low and distant. When he sounds either high or low notes, they are heard alike by him, and he describes them, together with my voice, as resembling the striking together of two pieces of metal.

Tinnitus aurium is nearly always present in these cases, and in fact in most of the affections of the middle ear.

Tinnitus is not found to exist, I believe, where the membrane and ossicles are absent, and I am inclined to the opinion that it never occurs without a sound to produce it.

Many disturbances of the mechanism of the middle ear convey to the nerve a sense of sound. A patient who had the tip oi a fishing-rod thrust through the membrana tympani said that the first sensation was as though a piano chord had been snapped.

In the normal condition of the ear, ordinarily, the sounds created by phonation and the circulation of the blood are not heard by the individual through tissue conduction from *within*, although others may hear them by the use of the diagnostic tube, or the individual may do so by stopping his own ears.[1]

Among the effects of the inhalation of chloroform, ether, nitrite of amyl, etc., or the use of quinia, or straining at stool, are hyperæmia of the ear, and the consequent temporary abnormity [temporary separation of the malleo-incudal joint?]

[1] For account of diagnosing tinnitus, etc., see article by J. Orne Green in these *Transactions*.

which permits the sounds of the circulation to be transmitted to the auditory nerve.

The noise made by contractions of the tensor tympani muscle when the hammer and anvil are separated may, it is possible, be heard by the patient; and they may be suspected of frequent reflex excitation as the motor nerve arrives from its source in the motor root of the trigeminus through the otic ganglion.

Tinnitus cannot probably have its origin in the incompressible cavity of the inner ear. The sudden increase of blood in the labyrinth, however, could force the stirrup outward, and its return would be attended with sound; in this way we may account for the peculiar "whistling" or "whirr" which attends labyrinthine vertigo. I have sometimes produced the whistling by making active rarefaction and condensation in the meatus where some form of aural disease existed. It also occurs during acute attacks, attended by collections of fluid in the middle ear. The condition of the conducting mechanism which occasions most of these abnormities is one *where the membrana tympani draws apart the malleo-incudal joint*, and is therefore unable to respond normally to the sound waves arriving through the meatus. The manner in which this separation takes place is explained by the mechanism of this joint, which has already been described. Sound from phonation and the circulation in the neighborhood of the ear, which has been referred to as constantly passing out of the ear without exciting the auditory nerve, is now effective upon the incus and stapes, irrespective of the membrane. The vibrations of phonation and of the circulation near the ear are conducted to it through structures which are much better conductors of sound than the air through which sound travels at the rate of 1,100 feet per second. An idea of the conductivity of bone, muscle, etc., may be formed from that of other substances. Through liquids its velocity is from 4,000 to 6,000 feet per second; through metals 4,000 to 17,000; through woods from 3,000 to 15,000.[1] It is probable, therefore, that the tissues, bone, muscle, etc., conduct

[1] *Sound.* Tyndall, Lecture I. New York, 1871.

sound with many times the velocity of air,[1] although it is at the expense of its definition, so to speak, from the variety of structures through which it passes, an interference resulting which depends upon the different velocities of the vibrations. This will explain the somewhat irregular character of sounds reaching the ear from within.

In making the diagnosis of these cases the tuning-fork is of much service, and if placed, when vibrating, on the mastoid process opposite the affected ear *it will be heard better, often exclusively, in the diseased ear.* Other portions of the head and face may be selected for placing the tuning-fork, but the above is believed to be the best, for the vibrations then pass through good conducting media (bone and air principally) in a direct course. When it is placed on the vertex the vibrations reach the ear from more than one direction; held between the teeth it is equally uncertain, for the sound then reaches the drum through both the inferior and superior maxillary bones: by the inferior arriving mostly at the meatus through the articulation in the glenoid fossa; and by the superior reaching the drum in all directions. The fork can be used sometimes to advantage when placed on Adam's apple, or upon the chin, while the mouth is open.

But the patient's voice, as heard by himself, is the most reliable test in many instances, being a sound he is accustomed to and can describe.

Experiments with one's own ears are of advantage as illustrative of the patient's condition: Close both meatus lightly with the forefingers, and perform phonation: the vibrations, not entering the external meatus through the air in the normal manner, are *heard much louder*, for they arrive at the drum through the better conducting medium of the intervening tissues, pass *out* through the delicate drum membrane without affecting it, to be reflected from the closed meatus *back again*, with increased resonance, to the drum membrane, which is then made to perform its excursions in the usual manner. Of course the tuning-fork vibrations can be availed of in a similar

[1] *Sound.* Prof. Alfred M. Mayer, p. 73. New York, 1878.

manner. Tinnitus, if it exists, is also louder during this experiment.

The vibrating fork, in certain cases of deafness, is heard plainly by the patient if held in front of the open mouth; if the mouth be opened and closed rather quickly, the sound will be alternately lost and heard, giving the patient a sensation of waves of sound.

If the mouth trumpet be used on a person with normal hearing, the voice will be heard thus spoken in the mouth, if the ears are closed.

If, when double hearing exists, the air in the meatus externus be gently rarefied or condensed, with the apparatus made for that purpose, the hammer and anvil will be brought together, and the anomaly will at once cease. As soon as the operation is suspended the double hearing returns. *In these cases the membrane will usually be found more or less relaxed.*

The diseases which cause dislocation of the malleo-incudal joint may be acute or chronic, and without going into details, which would be out of place here, it may be stated in general that tissue changes and the presence of fluids in the drum, conditions which are daily met with in aural practice, are sufficient to cause them. The tension of the membrane, when thinned, etc., is easily affected by fluids in the drum, and in acute inflammations the healthy membrane is often greatly bulged out by fluid exudations. Even a "cold in the head" may occasion striking effects: a medical man, who is very deaf, informs me that when he has a catarrhal attack of the naso-pharynx he experiences much better hearing as long as the attack is attended with discharge. In this case the tension of the membranes, which were found much relaxed, is doubtless rendered more tense by the hyperæmia excited by the nervous relationship existing between the parts affected and the ear.

A case of particular interest occurs to me in this connection. A man has had autophony in left ear for several months (following a subacute purulent inflammation of the middle ear), and in the right ear for a few days (there is now a very mild,

painless, subacute inflammation of left middle ear, with minute perforation, but no pus). When the symptoms cease for a short time in the left ear he experiences a decided increase of the autophony in the right. When he speaks, the sensation in the left ear is as though he were speaking into an empty vessel; after each word there is a sort of "echo" attended with a vibratory sensation, which he compares to the rattle of the chords stretched across the bottom of a tenor drum. In the right ear this "echo" also exists, but it is "muffled." When I place the diagnostic tube in the right ear I can distinctly hear a fluid gurgling as it is agitated by the air which enters from the Eustachian tube each time he swallows or breathes. When he performs phonation with mouth and nose closed the sounds come so plainly through his ear to mine, by the conduction through the diagnostic tube, that I *am convinced there must be considerable aerial conduction through the Eustachian tube.* When the vibrations from the vocal chords leave the tissues, in this case, and pass through the medium of the right drum, which contains both air and fluid, the sense of "muffled" hearing ensues; in the left drum, which contains only air, the sensation is like speaking in an "empty vessel."

The deafness occasioned by the presence of fluids in the drum is well known, and this condition is observed to exist to a greater or less extent in a large number of the cases referred to here, but to enlarge on this subject would be a digression.

The membrana tympani, which is so important to audition, when anomalous, becomes an impediment in some instances it would seem, as far as hearing is concerned, although frequently showing upon inspection but little evidence of disease. The perforations which exist in this portion of the mechanism are, as is well known, not always a cause of deafness themselves to any extent; and it is owing to this fact that an operation intended to establish an artificial opening in the membrane to relieve deafness has been observed with such anxiety by aurists. But probably a moment's reflection will convince any one that as sound passes through the membrane as readily as

light passes through the glass slide of the microscope, it is not the presence of the membrane that prevents waves of sound exciting the auditory nerve, for sound waves, both from *without* and from *within*, have free access to the tympanic cavity; while normal audition requires that the membrane and ossicles shall make to and fro excursions as a whole. The operation proposed by Voltilini is, therefore, unnecessary. An operation for the separation of the stapes from the incus, would be far more likely to be attended with success, and could we assure ourselves that the base of the latter bone was free it would be in some instances advisable.

Efforts to clear up the ground here are met by great difficulties, owing mainly to our inability to examine the parts thoroughly during the life-time of the patient.

The thickening of the tissues of the drum, and their completely changed appearance, render the parts indistinguishable, the ossicles under such circumstances being often invisible. The indestructibility of the membrana tympani is sometimes very marked, and it is probably absent in a far less number of instances than is generally supposed. The same remark may well be applied to the ossicles also; and we may conclude that entire absence of the membrane and ossicles are conditions which do not often exist; indeed, *so long as tinnitus is a symptom there is a considerable degree of action on the part of the mechanism.*

It is to be feared that the conclusions drawn from incomplete diagnoses here have been productive of great disadvantages to the progress of the pathology of this subject.

Fixation of the stapes, however, in the oval window, either by adhesions, thickening of the neighboring parts, or from action of the stapedius muscle, with or without destructive changes in the rest of the mechanism, must be a common occurrence; and although Burnett has shown that when the stapes is immovable the round window vibrates when sound enters the cavity of the tympanum, there is a doubt as to the existence of much hearing under these circumstances.

The ability to hear high tones, and not hear low ones; to

hear well in a noise, and the reverse, seems to depend upon conditions of the mechanism of conduction which are simple enough of explanation; but with varying anomalies in each individual case.

Two distinct conditions appear to contribute to the abnormities of hearing: disarticulation of the malleo-incudal joint, and alterations in the tension of the membrana tympani. In the dislocations above mentioned it requires a more or less heavy impulse, as the waves occasioned by the discharge of artillery or the concussion of thunder, etc., to force the membrane in far enough to form a close connection between the hammer and anvil, — the lesser displacements yielding to sounds of less amplitude. Burnett has shown that for deeper notes longer excursions are made. In cases of so great a degree of deafness as to require the shocks of thunder to excite the auditory nerve, the effect is usually painful. Where the membrana tympani is greatly relaxed (with possibly more or less separation of the hammer and anvil) the low shocks of a railway train in rapid motion will overcome the difficulty. The tick of a watch appears to be best heard in cases where the membrane retains its tension. By rendering the membrane tense by Valsalva's experiment, the excursions of great amplitude (as when on a railway train in rapid motion, on the noisy pavement, or in the presence of an orchestra while it is performing) are prevented reaching the auditory nerve. Whistles, bells, piccolo, flute, etc., however, are still heard. If the distention is carried to a painful extent the high tones are finally heard less distinctly.

It is well known that the hearing of some persons is affected by a moist or dry state of the atmosphere; which may be explained by the varied tension of the membrane produced by these conditions.

The too free entrance of air into the drum with the acts of respiration, swallowing, or yawning, although not affecting very much the normal membrane, may occasion great variation in the hearing of those affected with a dislocation of the hammer and anvil or a relaxed membrane. Atrophied mem-

branes seem to be exceedingly distensible, whereas in the normal state they are known to be inelastic. A consequence of elasticity is that the membrane does not readily move as a whole in response to ordinary vibrations of sound.

Patients with a relaxed membrane are likely to experience a crackling sensation when performing the acts of respiration, swallowing, or yawning, as the air entering the drum drives the membrane outwardly. The experiments of Politzer or Valsalva produce most unexpected effects on the hearing of these patients, greatly increasing the hearing of some for a short time, and making others very deaf; if repeated for a length of time, these operations are likely to render the membrane more relaxed, and thus increase the difficulty.

In conclusion, a few remarks concerning the inner ear may not be inappropriate to the subject.

The auditory nerve, it would seem, has only the power to perceive sound when its terminal fibres are irritated, not to produce or modify it in any way.

When exhausted or long disused it probably undergoes pathological, not physiological changes.

The question as to the ability of the inner ear to analyze sound may be relegated to the field of psychology; but that it can perceive every variety of sound, as the phonograph does, may be regarded as a fact; and although we may not be able to determine how the nerve perceives sound, we may well believe that cultivation has much to do with the perfectly developed perceptive faculties of the brain.

Grave diseases of the inner ear are not infrequent, and the auditory nerve is thus sometimes impaired; but too great importance has perhaps been given the affections of this portion of the ear, especially as regards the acoustical anomalies.

The occurrence of sudden deafness during the progress of constitutional affections is frequently ascribed to some lesion of the inner ear, although we know that a very slight appearing abnormity of the mechanism will disturb transmission of sound to the auditory nerve, even to the most profound degree.

Acute inflammations of the middle ear, it would seem, from continuity of surface, are more likely to affect the inner ear than invasions from the brain, and they are in fact of far greater frequency. Strict examination often indicates that deafness attributed to cerebro-spinal meningitis has most probably arisen from acute (painful) middle-ear affections.

The sudden deafness of syphilis has, beyond doubt, its principal seat in the conducting mechanism, for in all these cases which I have examined, *the vibrations of the tuning-fork, when placed on the head, are transmitted through the tissues to the auditory nerve, and are heard; and the patient can hear distinctly his own voice.*

The deafness from falls, blows upon the ear, etc., may mostly be attributable to lesions of the conducting mechanism; certainly greater knowledge upon this subject will refer fewer of them to the region of the inner ear.

This paper gives the results of much observation and thought on audition by one whose work is done in the midst of a busy life, in the hope that, from a pathological stand-point, he may contribute a few grains of truth to the specialism which has for him so much attraction, but he by no means intends to trespass upon the grounds of physiology or ignore the results of its labors.

THE USE OF ETHER IN THE TREATMENT OF THE CHRONIC CATARRHAL AND PLASTIC INFLAMMATIONS OF THE MIDDLE EAR.

BY GEORGE STRAWBRIDGE, M. D., OF PHILADELPHIA.

A FEW words as to the pathological conditions that will be met, and which, if possible, are to be removed.

The early stages of an acute inflammation of the middle ear are characterized by swelling of the mucous membrane, increase of secretion, and profuse separation of the epithelial cells; also increase of the connective tissue corpuscle; later,

newly developed tissue is found, not only interstitial in the normal mucous membrane, but also, in many cases, spread over its free surface, forming broad bands and adhesions, causing thickening of the tympanic membrane as well as the secondary membranes covering the round and oval foramina. It is also found adherent to the chain of ear bones, causing subsequent loss of their mobility.

Joseph Toynbee, in his "Descriptive Catalogue of Preparations Illustrative of Diseases of the Ear," describes eighty-three cases in which membranous bands of adhesion existed, some extending across the tympanum, binding the small bones to the membrana tympani : also the inner surface of the membrana tympani to the promontory. It is fair to conclude that in a great number of these cases we shall have to contend with a thickened mucous membrane, oftentimes complicated by false adhesions, calcareous deposits, strictures existing in the Eustachian tube, etc., — changes so positive as to readily explain why treatment so often fails of result.

The indications in the treatment of such a class of cases would be : —

First. To remove as far as possible the newly formed inflammatory products, whether they exist as adhesions, or are found in the tissue of the mucous membrane of the middle ear.

Second. To allow free entrance of air into the tympanic cavity by way of the Eustachian tube.

Third. To restore the normal movements of the tympanic membrane and chain of bones.

To meet the first indication I have been for the last three years using inflations of ether as a local application to the mucous membrane of the middle ear.

The method of application is to pour a few drops of ether (five to ten drops) into a Politzer bag. This will quickly and strongly charge the therein contained air with the ether vapor. This is forced into the middle ear by the usual Politzer's procedure. The immediate effect to the patient is somewhat startling, the sensation being compared to a stream of cold air

passing into the ear; but this quickly passes away, and is followed by a feeling of fullness, due to a temporary hyperæmia of the mucous membrane of the middle ear. Very rarely, slight giddiness is noticed, but this is very transient.

It is only necessary to look at the tympanic membrane immediately after such an inflation to convince one's self of the powerful effect of such an application. The membrane will be found intensely red, particularly between the anterior and posterior folds, and along the manubrium, showing the great temporary congestion produced by the ether.

In chronic diseased joints where exudation matter exists, great benefit is found from stimulating the circulation by means of blisters, irritating salves, etc., in order to promote the removal of the neoplastic matter. On the same principle I would use the ether inflations, with a view of removal of the neoplastic material existing in the tissues of the middle ear.

There is a great advantage in an application of this character over a solution thrown into the tympanic cavity for a similar purpose, in that, while the immediate effect is strongly irritating, no ether remains to act as a continuing source of irritation, such as would be the case by the use of an irritating solution. In other words, as regards the use of ether, the greatest effect is shown immediately after its application. That this has an effect not exercised by the air inflation alone is shown by the fact that numbers of cases treated by air inflation only, without benefit, showed great improvement from the ether treatment.

Therefore, as a means of promoting absorption of inflammatory tissue by stimulation of the circulation (which to me seems preferable to its removal by the use of caustics, as proposed by some), ether serves a good purpose. I am also inclined to believe that the tinnitus aurium, a so frequent accompaniment of these forms of disease, is often lessened by its use.

The remaining indications, namely, to allow free access of air into the tympanic cavity, and to restore normal movements to the chain of bones and tympanic membrane, would be met

by this plan of treatment. A quantity of ether-impregnated air, forcibly driven by the Politzer bag into the cavity of the middle ear, acts as a powerful mechanical agent.

These inflations are to be made every second or third day during a space of six to eight weeks.

The patient, if circumstances admit of it, is often placed under a corrosive sublimate treatment at the same time, until a moderate constitutional effect is obtained.

During the past three years I have treated a large number of cases, coming under the head of chronic catarrhal and plastic inflammations of the mucous membrane of the middle ear, by the above plan, and my general experience is favorable to a further continuance of the method, at the same time by no means wishing to make it exclude other favorably known methods.

SALICYLATE OF SODA AS A LOCAL APPLICATION IN CASES OF ASPERGILLUS NIGRICANS.

BY GEORGE STRAWBRIDGE, M. D., OF PHILADELPHIA.

Lately a prominent medical gentleman of Philadelphia presented himself with a well-developed attack of aspergillus nigricans, occurring in an ear which had suffered from suppuration of the middle ear, leaving a retracted membrane. This had occurred many years previously, and all active changes had long ceased. A saturated solution of salicylic acid was used to destroy the fungus, and repeatedly applied without effect. A twenty-grain solution of salicylate of soda was then used with entire destruction of the growth as the result. The application was made twice daily, until four applications had been made. No recurrence has taken place.

LUPUS VULGARIS OCCURRING IN THE AURICLE.

BY GEORGE STRAWBRIDGE, M. D., OF PHILADELPHIA.

I WOULD also like to lay before the society a fine drawing of a case of lupus vulgaris, occurring on the left ear of a woman aged twenty-four. It is well developed in the posterior surface of the auricle; also on anterior surface of lobule. This was first noticed seven years ago, and has been slowly growing. Its removal has been accomplished by the use of nitric acid.[1]

ON THE USE OF SULPHURIC ACID AS A LOCAL APPLICATION IN CASES OF DISEASE OF THE BONES OF EAR AND THE MASTOID.

BY ARTHUR MATHEWSON, BROOKLYN.

THE idea of applying the mineral acids locally in cases of diseased bone, for the purpose of dissolving the dead parts, is not a new one. Mr. George Pollock, surgeon to St. George's Hospital, London, in "The Lancet" of May 28, 1870, reports a number of cases of disease of the cranial bones, in which he had obtained most satisfactory results from the application of sulphuric acid. According to his observation it dissolved away the dead bone, while it spared the osseous tissues still retaining vitality, and promoted the process of repair through healthy granulations.

I do not know whether this method of treating dead bone has been followed by other surgeons or not, but it has been extensively used by the dentists. Atkinson, of New York, especially, has warmly advocated the plan. My friend Dr. William Jarvie, of Brooklyn, dental surgeon, to whom I have been indebted for other valuable suggestions, first called my

[1] A colored drawing of the disease was shown.

attention to the matter, and spoke so positively of the good results he had obtained that I determined to try the topical use of sulphuric acid in the first suitable case of caries of the bones about the ear which came under my care.

My experience with it has not been large as yet, and I cannot give an accurate record of cases as to dates, etc.; but in order to bring the matter to the attention of other otologists, who I hope may give it a more extended trial, I will briefly report that in three cases of mastoid disease, in which dead bone was found after Wilde's incision, the acid was applied with the result of apparently much shortening the process of exfoliation and repair.

Two of these cases were children with mastoid disease, connected with chronic suppurative otitis media; and the other, an elderly woman with mastoid disease resulting from a recent acute otitis media. In the former two cases the diseased bone was comparatively soft, and the aromatic sulphuric acid was applied to it with an atropine dropper. In the latter case the bone was hard, and the dilute acid, not seeming to make much impression on it, the strongest acid was applied, — the opening through the soft parts having been dilated by pledgets of cotton. The pain caused was but brief, and not severe.

Besides these cases of mastoid disease, I have tried the ordinary aromatic sulphuric acid in several cases of chronic suppurative otitis media, where I was led to think there was disease of the joints of the auditory ossicles, or of the bony walls of the middle ear.

In one such case, which had been under the care of Dr. Blake and myself for nearly two years, the effect of aromatic sulphuric acid dropped into the meatus was very marked in checking the discharge, which entirely ceased very soon after the use of the acid was begun, and in correcting the very offensive odor.

Dr. Blake informs me that he has used the dilute acid through his middle-ear syringe with good results.

The pain caused by dropping the aromatic acid into the ear is not severe, and I have learned to regard it, after careful experiment, as an entirely safe application.

The advantages of an agent which will act on dead bone, while its action is limited by the living tissues in places where operative interference is impracticable or too dangerous, need not be dilated on.

CASES OF PERFORATION OF SHRAPNELL'S MEMBRANE, COMPLICATED WITH OTHER AURAL LESIONS.

BY H. G. MILLER, M. D., OF PROVIDENCE.

FROM the cases of perforations of the membrana flaccida, published by Drs. J. Orne Green, Blake, Buck, and Burnett, we have become quite familiar with this lesion. Since the writer's attention was called to the subject, he has observed six cases out of a total of 1,351, occurring about equally in hospital and private practice, or something less than one half of one per cent. of all cases. Of these, three presented no special features, but the other three, being accompanied by other lesions of the ear, may not be unworthy of being recorded.

CASE I. This resembles Dr. Burnett's Case V.,[1] in which ulceration was caused by the presence of hardened wax, except that the pain was very intense instead of moderate, and actual perforation had already taken place when the membrane was exposed to view by the removal of the obstruction. F. C., twenty-four years of age, three days ago, after holding his head under the cold-water faucet, felt intense pain in left ear. This increased, until it became excruciating, and extended over the whole side of his head. He obtained some relief from the pain by an anodyne given by his physician; but there is still severe suffering and great deafness. H. d. w. $\frac{c}{100}$. After the removal of a firm plug of wax, the region of the membrana flaccida is seen to be intensely red, and from a point directly above the short process of the malleus a drop of pus slightly tinged with blood is seen to be oozing. A staff finely tipped with cotton and applied very gently, penetrates a small opening in the membrane. After this the hearing distance is found to be .80 of normal. A rhythmical, rushing noise, synchronous with the beating of the pulse, ceased after the removal of the obstruction. Without further treatment the perforation healed in six days, and there was no further discomfort whatever. The h. d. remained at .80. Here the inflammation seems to have been caused

[1] *Treatise on the Ear*, p. 342.

by the wax which already filled the passage, being made to swell by the thorough soaking with water and pressing upon the membrane, or else by the direct effect of taking cold; probably the former.

Case II. C. H., aged twenty-six. History of chronic suppurative otitis media in both ears from childhood. In the left ear were two small perforations downwards and forwards in the membrana tympani, and several small polypoid growths, which were pinched off by the round-pointed angular forceps.

In the right ear the inner fourth of the meatus was nearly filled by a polypoid growth, having its attachment upwards and forwards, and concealing all but a small crescentic border of the drum membrane posteriorly. An endeavor was made to remove this by Blake's snare, but owing to the very firm texture and broad base only a small portion was cut off in that way. By repeated cauterizations with arg. nit., and then with dichloracetic acid, the growth was finally destroyed. The whole membrane being thus brought into view, a perforation of about one and a half millimeters in diameter was seen in the membrana flaccida. In this case, unlike most of those reported, Politzer's inflation produced the perforation sound, and Valsalva's method showed under the eye a profuse discharge of thin pus issuing from the perforation After thoroughly cleaning the cavity an injection was made into it of one half minim of arg. nit. sol. gr. xl. to fl. ℥j., a Weeker's hollow tear-passage probe, fastened upon a subcutaneous syringe, by which the exact amount of liquid to be used can be graduated, being used for that purpose. The discharge diminished after the first injection, and after two or three repetitions had becom every slight. H. d., which had been $\frac{6}{100}$, increased to $\frac{4}{100}$. With syringing and a solution of zinc, sulph. gr. iv. to fl. ℥j, the discharge ceased entirely, and H. d. became $.\frac{12}{100}$, with good hearing for conversation.

Case III. The third case was complicated with disease of the labyrinth. A. E., now aged fifty, about thirteen years ago was attacked with severe pain in left ear; this was accompanied with distressing nausea and vomiting, giddiness, and general headache. The severity of the pain was relieved by a subcutaneous injection of morphia. But there was complete deafness on that side, and the nausea and dizziness gradually diminished, and then ceased rather suddenly on the appearance of a discharge from the ear. This continued and began to have a peculiar odor, and he consulted a distinguished aurist, now deceased, who spoke of the lesion as a sinus, and injected it with a strong solution of arg. nit. This checked the discharge, but had to be resorted to again at intervals for several years. The deafness remained the same. When seen by the writer, the 'sinus' was found to be an opening in Shrapnell's membrane of two millimeters in diameter. There was no hearing for the watch, and none for the tuning-fork, by bone conduction. There was a feeling of tension and discomfort in the ear, with slight discharge. Granular tissue, which bled on being touched with a probe, could be distinguished within the opening. A strong solution of arg. nit. gave relief to the sensation and stopped the discharge. This has had to be repeated at intervals of several months, whenever the symptoms have recurred.

OBJECTIVE AND SUBJECTIVE SYSTOLIC MURMURS IN THE EARS.

A CONTRIBUTION TO THE STUDY OF BRAIN MURMURS.

BY J. ORNE GREEN, M. D., BOSTON.

H., a boy eight years old, of exceptionally fine intellect, well developed, and apparently in good health, with good ossification in general, and with a firmly ossified skull, was subject to occasional severe general headaches, during which he complained of what he called a "whizzing" in the ears. One evening, when thus complaining, his mother placed her ear upon his ear and distinctly heard the same sound, and Dr. Langmaid, the family physician, being summoned, although the boy was asleep on his arrival and during the earlier part of the examination, was able to hear the sound at a distance of several inches from the patient's head.

The next day, December 15, 1877, I saw him with Dr. Langmaid; he was then apparently in perfect health, complaining of nothing. The sound still continued, although not as loud as on the previous evening; it was musical, and was determined by Dr. Langmaid, who possesses a very delicate ear, as g''; it was intermittent, synchronous with the pulsation of the carotids, much louder in one ear than the other, but of the same pitch in both. It could be heard on placing the ear upon his auricle; better still by connecting my ear with his by the otoscope; and best by covering his ear with the small end of a Camman's stethoscope. It was located directly in the meatus; was not heard over any part of the skull or mastoid, nor below the ear in the neck. The sounds of the heart were normal, as were those of all parts of the chest; no abnormal distention of carotids or jugulars, and no murmur or thrill in them. Slight pressure over either carotid stopped the sound completely in the corresponding ear. There was no anæmia, no dizziness, and no constitutional disease.

A subsequent examination, a few days after, with Dr. Lang-

maid, confirmed all of the statements, and also showed that at times the sound was entirely absent, and at times so low that it could only be heard with a Cammann's stethoscope ; the sound when it existed was always of the same pitch.

A most careful examination showed absolutely no abnormal appearance in the ear, throat, or nose ; the hearing for watch and voice was perfect, and there was no distinction to be discovered between the ears by bone conduction.

When first examined, while lying in bed, by Dr. Langmaid, the sounds were objectively louder than at any other time ; at the subsequent examinations, the question of whether they were altered by the position of the patient was not investigated. The boy was remarkable in the family for his very ready and easy blushing.

June 15, 1878, C., aged fifty-nine, school-teacher, seen with Dr. Cornish, of East Boston : a large man, weighing 210 pounds, but not excessively corpulent; always blushes very readily, and this was very marked on his visit to me. Has always considered himself a healthy man ; has never had an ill day, and can endure a great deal of physical exercise ; remembers, however, that ten years ago he was refused by a life-insurance company on account of irregular action of heart, and has noticed occasional palpitation always with indigestion from some forbidden article of food, and on questioning acknowledges that he is rather careful in his diet on that account. Within the last year has not felt as strong as usual, and has noticed an occasional irregularity of the heart's action, *i. e.*, there is an occasional and irregular loss of a beat, but he is not certain that this is new. Some three or four months ago began to notice noises in the ears, and about the same time there was marked debility, loss of strength and appetite.

Since then the noises have become louder, on the whole ; are continuous, but variable in their intensity ; and recently they have interfered much with his sleep. To him the character of the noises varies very much at different times, but he could not compare them to anything ; they are, however, always intermittent, *i. e.*, pulsating. Recently there has been occasional

dizziness, never severe. The noises are increased in loudness to him on exertion, and also by positive pressure in the meatus, *i. e.*, by closing the passage by the finger or by laying on a pillow; they are not changed by position of the head. Patient says he "feels the sound come from the region of the heart," and when it is loud "he feels it all over."

After these sounds had continued for some two months he consulted Dr. Cornish, and requested him to listen to his head. On placing his ear to the patient's meatus the Dr. heard the sounds distinctly, and also thought he heard them over the skull. Some ten days afterwards I saw him with Dr. Cornish.

With a Camman's stethoscope over either ear the sounds were heard faintly, but undoubtedly; they were synchronous with the pulse at the wrist, and resembled more than anything else a rather high-pitched bellows-murmur. They were not heard when I saw him except in the meatus; neither on the vertex, occiput, or mastoid; nor was there any murmur over either carotid, as would have been expected if it was a transmitted sound from the chest. There was no distention or sound in the carotids and jugulars. Slight pressure over either carotid diminished the loudness of the sound in the corresponding ear both objectively and subjectively; deep pressure, enough to thoroughly compress the carotids, checked it entirely both objectively and subjectively.

The pulse showed an occasional and irregular loss of a beat; was otherwise without anything abnormal, seventy-eight per minute. The sounds of the heart were normal except the loss of a beat, as above.

The ears were normal: each membrana tympani was normal in appearance and of normal movement by Valsalva's inflation; hearing perfect for watch and voice; tuning-fork on forehead equal in the two ears; w. r. $\frac{84}{84}$: l. $\frac{60}{84}$; but closing one ear increased the subjective noises so much that this probably produced the apparent difference in the two ears. Voice, a low whisper, was heard twenty-four feet in each ear.

June 29, another examination was made confirming in every particular the above results; the sounds were, however, less

loud than on the 15th, but still distinctly heard in both ears. Dr. Wadsworth was kind enough to examine the eyes on June 29, and found a little conjunctivitis of the right eye, and some astigmatism in both. Vision in the right, with + 36 cylindrical and + 48 spherical, was $\frac{4}{5}$; in the left, with + 42 cylindrical, $\frac{4}{5}$. The fundus was normal in each eye. On being questioned he said that three or four years ago, before any of his present trouble was felt, he had noticed that he could not see as well with the right as with the left eye.

[Since writing this report I have heard from both patients. The boy has had no return of the noises now for some months. In the man the noises still continue, have increased in intensity, and it is asserted that they can now be heard distinctly over the whole skull; the general health is fair, he says better than in the spring: he has become accustomed to the noises, so that they do not trouble him as formerly.]

In both of these cases I think we are justified in asserting that the sound was in the arteries near the ear, in direct and very close connection with the carotids; it could be heard only in the meatuses, and nowhere else; it was certainly diminished or checked entirely by pressure which diminished or checked the flow of blood through the carotids; it was heard in both ears and must have been due to some cause which existed on each side, for deep pressure upon one carotid checked the sound entirely, both objectively and subjectively, in the corresponding ear, but had no influence upon the sound in the opposite ear; it was not heard in the course of the large vessels of the neck nor in the chest, and therefore was not a transmitted sound. As the blood-vessels of the meatus, tympanum, and labyrinth are all of a minute size, it is impossible to imagine any possible condition, in a healthy ear, where any of these would be capable of giving any sound approaching in intensity that which existed in these cases, and which in the boy was occasionally so loud that it could be heard several inches from the ear. The internal carotid artery, however, lies in very close relation to the tympanum, being separated from that cavity merely by a very thin plate of bone, and more-

over for about one inch runs through a firm osseous passage, the carotid canal of the petrous bone; thus furnishing favorable conditions, from its close proximity to the ear, for the easy transmission of vibrations from it to that organ; and also its osseous surroundings furnish an unusually favorable medium for the transmission of these vibrations, while the meatus and tympanum afford an easy passage for the vibrations to reach the external air without being absorbed by soft tissues. I should therefore seek for the source of the sound in the carotid artery within the petrous bone. The total absence of the sound in the neck and chest is conclusive against its being transmitted from any distant part of the circulation, for although it is true the soft tissues do not afford a favorable medium for the transmission of vibrations, still the arteries of the neck lie so superficially, and those of the chest are so large, that any sound of the intensity existing in these cases must of necessity have been heard.

The pitch of the sound differed in the two cases, being much higher and of greater intensity in the boy than in the man; in both it was distinctly pulsating and synchronous with the pulse, as has been said; in both it varied in intensity at different times, but was always of the same pitch; in the boy it was frequently absent for days; in the man from its beginning it had been constantly present. In the man closing the meatus increased the intensity of the sound very decidedly to him, as would have been expected in the case of any sound which originated within the head; in the boy it was impossible to learn that any such change was noticed.

In both there were certain abnormal conditions which were noticed when the sounds were present: in the boy the sounds were always complained of during and after general headaches which could only be classed as nervous, as they came on after violent or exciting play, and were apparently independent of any digestive trouble; in the man the sounds appeared just about the time he had begun to notice a loss of strength and appetite, when in fact there was some debility. The peculiarity of the heart's action in the man I think we can exclude as of

any influence on the murmurs, as it had existed for a long time, probably for years, and was certainly present long before the ear symptoms were felt. One peculiarity in both cases is worthy of special mention: that is the extreme sensitiveness of the vaso-motor nervous system, as shown by the intense and rapid suffusion of the face on the slightest excitement or surprise, — a condition to which both were subject, and which had been often noticed by their friends.

In both cases we have, then, systolic murmurs heard both subjectively by the patients themselves, and objectively by any ear connected with the patient's meatus; in all probability these murmurs arose from the carotid arteries in their courses through the carotid canals of the petrous bones. In both cases there existed pathological conditions, which apparently caused the sounds.

Richardson, in his work on the diseases of modern life, in speaking of the functional diseases arising from the abuse of alcohol, describes subjective noises in the ears as one of the symptoms accompanying alcoholic dyspepsia. These are produced, he says, by a reduced vascular tension, especially of the internal carotid artery, which allows the walls of the artery to lie in direct contact with the osseous walls of the canal in the petrous bone, and thus permits the transmission of the vibrations of the blood directly to the osseous structures in close connection with the ear. He does not speak of these vibrations as ever being heard objectively, but if his explanation is the true one the noises are positive, in contradistinction to the subjective irritations of the auditory nerve, which are purely sensational; and this being the case the perception of the sounds objectively, *i. e.*, by another person, must merely depend upon their intensity. This explanation of Richardson's it seems to me is very possibly applicable to these two cases, for in both there were pathological states which could have induced a reduced vascular tension. Unfortunately, any experimentation to determine this was impossible.

The study of brain murmurs in children has of late excited considerable interest, the subject having been revived by the

work of Jurasz,[1] and since then investigated by Epstein [2] and Hennig.[3]

Jurasz examined sixty-eight children of all conditions of life; the youngest of these was five months old, the eldest four years; in twenty-six of these, murmurs were heard in the brain by auscultation of the skull. His conclusions were that these murmurs were not dependent on the constitution, health, state of ossification or peculiarity of the skull, but were influenced, as has been asserted by other authors (Fisher, Rilliet-Barthez, Roger, Wirthgen, Hennig, Steffan, Henoch, Von Ritter, and others), by the age of the child. In regard to their cause, he says, "The systolic brain murmur is caused by the fact that the gradually enlarging carotis interna (and probably also the meningea media) is relatively disproportionate to the unyielding osseous canal, and thus the artery is partially stenosed till the pressure of the pulse-wave gradually enlarges the canal. The systolic brain murmur is therefore only a physiological phenomenon, in no direct connection with pathological conditions. It can therefore never be of value as a means of diagnosis."

His examinations, he claimed, showed that from birth up to the age of six months the entrance and exit of the carotid canal of the petrous bone are unaltered; from the age of six months to six years they gradually enlarge; and at six years become of the full adult size. These five and a half years are the time when the brain is rapidly enlarging, requiring more and more blood for its nutrition; hence the enlargement of the carotid artery and the temporary physiological stenosis of the canal from the fact that the artery enlarges more rapidly than the canal.

Epstein studied twenty-two cases, not selected, and found that the brain murmur occurred preferably in rachitic children. Of these cases thirteen were boys and nine girls, vary-

[1] "Das systolische Hirngeräusch der Kinder." *Historische und Klinisch-Anatomische Untersuchungen.* Heidelberg. Carl Winter. 1877.

[2] "Beitrag zur Kenntniss des systolischen Schädelgeräusches der Kinder." *Prager Med. Wochenschrift*, Nos. 18 and 19, 1878.

[3] "Ueber die Kopfgeräusche bei jungen Kindern." *Med. Gesellschaft zu Leipzig.*

ing from five months to four years of age. In older children the brain murmurs were never found. In four of the twenty-two cases examined the skull was perfectly ossified; in eighteen the anterior fontanelle was open. Four of the children were healthy; eighteen suffered from rachitis. The intensity of the murmurs was variable: where the fontanelle was open the murmur was intermittent and distinct; where the fontanelle was closed it was continuous and weak; the tone was higher over the temporal bone at the spot corresponding to the arteria meningea media. In all of the cases examined a murmur was also present in the carotid, which corresponded in intensity and character with the brain murmur. In some of the cases the cruralis was likewise examined, but no murmur was found.

Epstein then examines the conditions which produce arterial murmurs, and defines them as follows: —

(1.) Enlargement of the arteries.

(2.) Increased swiftness of the blood-current.

(3.) Diminished peripheral opposition in the vessels.

(4.) Elasticity and thinness of the walls of the vessels.

All of these conditions, he says, produce diminished arterial tension, and all of them are united in childhood.

All of the arteries are relatively wider in children than in adults, and this is especially true of the arteries of the head. Increased swiftness of the blood-current in children is shown by their rapid pulse and diminished peripheral opposition in the vessels by their relatively large arteries, small heart, and the large size of the capillaries. The fourth condition is also present in children, the arteries not yet having become firm.

He says that the murmurs vary, probably from variable dynamic conditions of the circulation, and also that they can be checked by holding the breath, which produces an increased resistance in the brain from congestion. Rachitis he considers, although not a direct, still an important factor in their production. Anæmia, he says, does not in itself cause arterial murmurs, but is an expression of a general disease with which a diminished arterial tension is united. He acknowledges the existence of brain murmurs in healthy children. Hyperplastic

lymph-glands by pressure upon and diminution of the calibre of vessels may produce murmurs.

Epstein's conclusions are that : —

(1.) The brain murmurs originate in the carotid and larger intracranial vessels.

(2.) The most favorable age for their existence is between six months and two years of age ; the extreme limits bring three months and six years.

(3.) Childhood offers proper conditions for their development, more particularly a diminished arterial tension.

(4.) Constitutional diseases, especially rachitis, which interfere with the development, predispose to them.

(5.) Swollen lymph glands may also produce them.

(6.) The skull murmur is not a physiological phenomenon.

Henning calls attention to the fact that brain murmurs were first investigated by Dr. J. Fisher, of Boston, in 1832, but claims that he himself was the first to demonstrate that they were merely a physiological phenomenon. He disagrees with the assertion of Jurasz that the murmurs are uninfluenced by position, as he found them louder when the subject was in the erect posture ; he also says that Jurasz's explanation that the murmur is caused by compression on the carotid, owing to incomplete enlargement of the carotid canal, does not hold good in all cases, as they are found in cases where ossification is well advanced, and where, therefore, it is reasonable to suppose that the carotid canal is fully developed.

In the "Monatsschrift für Ohrenheilkunde" for April, 1878, Poorten reports the case of a man who suffered from spinal irritation, neuralgia, and other nervous symptoms, on whose left side a systolic murmur could be heard eight inches from the ear ; this had followed a blow on the left parietal bone. The murmur could be heard in the left side of the neck on the level of the thyroid cartilage, and from that point increased in intensity as the ear was neared, was loudest in the meatus, and then diminished in intensity towards the occiput, but could be heard even to the seventh cervical vertebra ; it could not be checked by compression of the common carotid, although the

account states that such compression could not be borne more than two seconds; it was diminished by positive pressure in the meatus, and increased by negative pressure. The heart was normal. Poorten gives a *résumé* of other cases of objective murmurs which have been described: the first of these was checked by compression of the arteria auricularis posterior, and is referred by Grüber to an aneurism of the basilar artery, and by Von Troeltsch to "peculiarities in the branches of the posterior auricular artery, and changes in the parts to which this artery is distributed;" in the second case there was a systolic murmur in both heart, ear, and head, which was probably a transmitted sound from the heart; in the third case there existed an arterio-venous aneurism between the internal carotid artery and the cavernous sinus; other cases are given of aneurisms of the orbit, which were accompanied by murmurs heard more or less distinctly over the head.

All of these authors except Poorten discuss only brain murmurs in children; Poorten's and my cases show that such may also exist in adults.

Although at first sight it would seem that all of these authors differ widely in their opinions, close examination will show that many of their statements can be reconciled. Jurasz considers the murmurs as a physiological phenomenon due to the stenosis of the carotid artery referable simply to the age of the patient; he does not acknowledge a pathological murmur. Epstein asserts that they are more common with open fontanelles, when, therefore, the ossification is imperfect, and the stenosis of Jurasz would be much more likely to exist; that they are louder over the arteria meningea, but he seems not to have tried the meatus, and cannot say whether they were still louder at that point; that they were heard also in the carotids, of the neck, but if this was the case, it is no proof that they originated there, for if they arose from the petrous canal they could have been transmitted to the neck, as in Poorten's case; that they were not heard in the other large arteries, as the cruralis, and were therefore certainly not dependent

on any peculiarity of the blood, and probably not on any condition of the arteries alone, but rather on the condition of the arteries together with certain peculiar relations of the arteries to other parts. Epstein asserts that the murmurs originate in the carotid and large intracranial vessels, and suggests particularly a diminished arterial tension as their cause; he thus seems to regard them as chiefly pathological, although he acknowledges that they are sometimes found in what seem to be healthy subjects. He brings forward no facts to prove or disprove Jurasz's physiological stenosis of the canal.

Diminished arterial tension of itself would hardly produce a murmur, certainly not one to be perceived objectively, but such reduced tension in an artery with the anatomical relations of the internal carotid in the petrous bone would allow the vibrations of the arterial walls to be communicated to the bone, thence to the ear of the patient, and through the auditory meatus to another person.

Poorten's own case could readily be referred to this reduced tension of the internal carotid artery; at least, there is nothing in the history to militate against this theory. The other cases quoted by him are most of them so distinctly aneurismal, a condition which is well known to produce murmurs, that they need not be considered in this connection.

The direct cause of arterial murmurs in general, whether due to vibrations of the blood or to vibrations of the vessels' walls, need not be discussed here; the facts are that in certain persons murmurs do exist in the vascular system of the head, which can be heard both subjectively and objectively.

It seems probable that these murmurs may be divided into three classes: —

Physiological murmurs in the internal carotid, dependent on partial stenosis of the carotid canal.

Pathological murmurs in the internal carotid, probably caused by a reduced vascular tension, dependent upon disturbances in the vaso-motor system.

Pathological murmurs from aneurisms of the vessels of the head.

A CASE OF CHRONIC SUPPURATIVE INFLAMMATION OF MIDDLE EAR, WITH EPITHELIAL TUMOR EXTENDING UPWARD INTO CRANIAL CAVITY; ALSO WITH EXTENSIVE NECROSIS OF THE MASTOID AND OTHER PORTIONS OF TEMPORAL BONE, WITHOUT EXTERNAL SWELLING.

BY ARTHUR MATHEWSON, M. D., BROOKLYN, N. Y.

THE title of this paper will indicate why the following case seems to me worthy of record.

Mrs. McColl, aged twenty-seven, with nursing infant, of good general health and strong constitution, first consulted me November 14, 1876, on account of pain in her left ear, which had begun three days before. There had been a discharge from the ear for years, its hearing was somewhat impaired, and on inspection it presented appearances common in cases of chronic suppurative otitis media, viz., a perforated drum membrane, with hard whitish fibrous granulations projecting through the opening out of the tympanic cavity.

There was no swelling of the soft parts over the mastoid, tenderness on pressure, or other appearances to account for the pain. The granulations were at first touched with a strong solution of nitrate of silver, and she was directed to douche the ear frequently with warm water.

The pain did not subside, and leeches, and afterwards counter-irritants and blisters, were applied about the ear, but with very little effect. Her sufferings continued on through the winter following, increasing in severity. The appearances still remained unchanged. The granulations referred to were picked away with forceps, and at the suggestion of Dr. Roosa, who had seen the case, touched with nitric acid. The discharge from the ear was very offensive, and at times mixed with blood. I did not detect dead bone with the probe.

On the 18th of March, 1877, with the hope of giving some

relief from the tortures the patient was undergoing, a free incision was made over the mastoid, though the usual indications of mastoid disease were still absent. This had been often proposed before, but as the patient was much averse to the knife, and Dr. Roosa agreed with me in thinking the indications for its use were not urgent, it had been deferrd.

To my surprise, on cutting through the soft tissues, which were neither swollen or tender to touch, I found very extensive necrosis of the mastoid, and the probe passed readily through a considerable opening into a large cavity in the bone filled with fetid pus.

The relief afforded by the incision was only partial and temporary. Pieces of dead bone were removed from time to time.

On May 24, in consultation with Dr. Skene, the former incision being inclined to close, a freer opening was made behind and above the meatus, and many pieces of dead bone and a large mass of soft granulation tissue removed. Fluids syringed into the opening passed freely out at the meatus. After this a wide opening remained down to the dura mater, and the pulsation of the intracranial vessels could be plainly seen. The soft tissues of the vicinity became enormously swollen.

There were no symptoms of cerebral disturbance; the pupils were regular, the optic disks normal, and the patient's general condition surprisingly good, considering the intensity of her sufferings. The pain was referred to the vertex and occipital region rather than to the ear. No relief was obtained except by opiates. The disease of the bone extended, and the condition of the patient gradually grew worse, till on the 27th of July, 1877, she died, apparently of exhaustion, having been unconscious for some time previously.

The autopsy was made by Dr. J. C. Shaw, a skillful neurologist, whose notes are as follows: —

"On removing the brain there was seen projecting from the floor of the skull, just over the petrous portion of the temporal bone on the left side, a whitish tumor about the size of a large hazel-nut, soft to the touch. It made a depression on the under surface of the temporo-sphenoidal lobe of the brain.

The dura mater, covering the whole temporal bone, and extending back to the occipital, and down into the foramen magnum, and over the wing of the sphenoid and sella turcica, presented an opaque, dull, soaked appearance, and was partly detached from the bone. The periosteal surface of the dura was covered with the new growth, varying in thickness at different points, but greatest over the ear.

"The bones of the labyrinth (semicircular canals, cochlea, etc.) appear to have been detached *en masse*, as they are found in the midst of the growth, simply held in place by the auditory nerve. On removing the dura covering the temporal bone, it was found that the whole mastoid and petrous portions were gone. The *Gasserian* ganglion and fifth nerve were involved in new growth. The brain was normal. The chief points of interest in this case, from a pathological point of view, are, What was the starting point of the growth? How is it there was no neuralgia of the fifth nerve? Why was there not that grouping of symptoms which are designated Ménière's disease? In answer to the first of these questions it appears to me that the growth must have had its origin in the middle ear, and extended to the dura mater, and that as it progressed and involved that portion lining the mastoid the nutrition of the latter was interfered with, and slow death of the bone brought about; and this appears to me to be the reason why the ordinary symptoms of inflammation of the mastoid were not present.

"According to the two views as to the causation of the symptoms designated as Ménière's disease, — first, lesions in the semicircular canals, and second, irritation of the auditory nerve, — we ought to have had these symptoms present in this case."

In addition to the points of interest noted by Dr. Shaw, it is remarkable that, in spite of the condition revealed by the post-mortem examination, her hearing on the affected side, when tested a short time before she became unconscious, was still such as to enable her to understand ordinary conversation at the distance of eight or ten feet.

Ophthalmoscopic examination revealed no swelling of the optic nerve disk, such as is nearly always found in cases of intracranial tumor. This may perhaps be accounted for by the relief of pressure afforded by the large gap in the walls of the cranium. Careful examination of the specimen by Dr. Shaw and other skillful and experienced microscopists showed the growth to be an epithelioma.

AURAL INFLAMMATIONS WITH EXANTHEMATA.

BY H. N. SPENCER, M. D , ST. LOUIS.

I HAVE been led to offer the case which constitutes the argument in this paper, not to present anything which is contrary to the entertained views of members of this Society, as I believe, but for its applicability to meet an error that I find prevalent to an extent which is dangerous. I refer to the opinion entertained by many that the aural inflammation with the exanthemata has a specific character, and consequently must not be interfered with ; that it is an exanthema of the mucous membrane, to arrest which (being possible) might be attended with more serious consequences to the patient than could result from allowing the progress of the local inflammation. This belief, no doubt, has its foundation in the views of Härlin and others who have declared the specific character of the scarlatinous angina.

That I may not seem to be overdrawing the danger, or magnifying the extent to which erroneous views upon this subject prevail, I will state that I have selected this one out of five bedside cases of acute suppurative inflammation of the middle ear, associated with exanthemata, which I have been called to attend, in a whole number of 2,426 cases of ear disease, seen in private practice in eight and one half years.

CASE. Willie Waldron, aged ten years, was attacked in January, 1877 with, scarlatina. Professor John T. Hodgen had charge of the case. On the fifth

day following the eruption, there occurred a suppurative inflammation of the middle ear. There was no pain, and the ear inflammation at this stage, under such circumstances, might have escaped less observant attention. Professor Hodgen requested me to see the case, and repairing to the house I found, in the short interval between his summons and my response, that rupture of the membrane had taken place, and that there was copious discharge from the ear (the right). After cleansing, upon examination, I found a free vent in the membrane for the escape of matter from the tympanum. The rupture was gaping — central of the membrane, — embracing almost the entire vertical diameter. The edges of rent were very red. All the normal features, including the manubrium mallei, were obliterated in the changes consequent upon the inflammatory process. The naso-pharyngeal mucous membrane was inflamed, and presented quite an abundant secretion. The pharyngeal examination displayed a slightly œdematous uvula, and the tonsils very much enlarged. The tonsils were dotted with points of ulceration.

The general condition of the patient: Desquamation had begun. There was considerable exhaustion. Fever slightly exceeding that of the day before.

Treatment consisted in the warm douche (saline) application to the ear, politzerization of the tube, and hot spray application to the pharynx. I used Monsel's solution of iron on the tonsils.

The progress of the case was quite as good as we have ordinarily in acute suppurative inflammation of the tympanum, occurring under other circumstances. In two weeks the ear trouble had disappeared, and the membrane had healed. I had valuable assistance in the constitutional treatment of the case.

I am aware that the only evidence of pathological change is that which the post-mortem table affords; but we have here certainly an *a posteriori* argument for these conclusions: —

There is no pathognomonic condition of the lining membrane of the middle ear, when it has become inflamed in the exanthemata.

The course of the inflammation does not differ from that of otitis media purulenta (acute) occurring under other circumstances (given a systemic disturbance equal to that produced by exanthemata).

The indications for treatment are those which obtain commonly (always influenced by the general condition of the patient).

The prognosis is always favorable.

Burnett, in his treatise on the ear, propounds to himself the question, "Is there a specific tendency in the aural disease of scarlet fever to become chronic?" and reflects: "Upon close

examination of these cases, it will be found that though the sufferer has passed through a disease which has made him liable to affections of the mucous tract, neglect of the acute inflammation in the ear has done the real mischief. Were this not true, then prompt attention to the inflamed ear in scarlatina would not be fraught with the good result it always is."

The frequency — apparently increasing — of chronic purulent inflammation of the middle ear makes this subject one of serious moment, and we cannot, either too frequently or too forcibly, call attention to this most fruitful source of it.

I have not designed in this paper to make any discussion with those who may entertain peculiar views, the truth or falsity of which would in no wise influence the indications for interference which are plainly presented. The hesitancy to prompt action in the aural inflammation with exanthemata can only be satisfactorily explained by attributing ignorance to the attendant. In the first place, it implies want of information respecting dangers which threaten the system both locally and remotely; and again, it shows an insufficient knowledge of the result which experience has taught may always be obtained.

ZAUFAL'S SPECULA.

BY J. S. PROUT, M. D., OF BROOKLYN, N. Y.

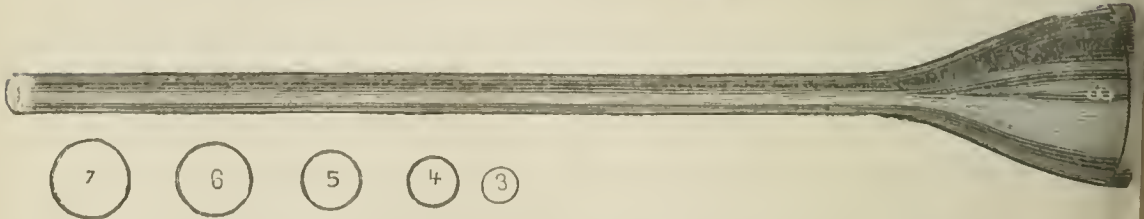
In 1875 Prof. E. Zaufal, of Prague, described, in the "Prager Med. Wochenschrift" and other medical periodicals, specula which he had devised for the examination of the naso-pharyngeal space and the treatment of its diseases. A *résumé* of what had been done by others and his own experience is contained in a paper by him in the "Archiv für Ohrenheilkunde," Band xii., 1877, pp. 243, 281, a reference to which will render further citations at this time unnecessary. He has this year published two additional papers on this subject in the "Prag. Med. Wochenschrift," which I have not seen, one of which is

in reply to Professor Voltolini, who, in the same periodical, disputes Zaufal's claims to originality, and denies the availability of the method.

I have used the specula repeatedly on my own patients with much satisfaction, and in one case of adenoid granulations with benefit to the patient. I am not able to discuss or decide the question of originality, but if Voltolini undertakes to deny the usefulness of the method he shows that he has not fully mastered it.

A new thing almost of necessity meets with opposition. These specula were also criticised by Professor Von Schrötter, of Vienna, who said (I quote at second hand from memory) that the large ones are too large to enter the nose, and the small ones are so small that one can see nothing through them. As I am able to use them satisfactorily on my patients I can only account for such a statement by supposing that the Professor, an accomplished laryngoscopist, had not seen them properly used, and therefore did not fully understand their use. For the same reason, as I am informed by a private letter from Vienna, written in February of this year, so able a teacher as Professor Grüber had not then gotten beyond the Von Schrötter stand-point. The introduction of them and the *recognition* of what is seen are matters of very considerable difficulty, so that without special instruction therein one will be very likely to find them of but little value. Professors Von Troeltsch and A. Politzer, to whom otology owes so much, commend the method, and advised the writer to visit Professor Zaufal in order to learn it.

The accompanying cut, for which I am indebted to F. G.



Otto and Sons, of New York City, who published a description of these instruments in the "Medical Record" for July 20, 1878, p. 59, to which I beg leave to refer, shows their shape

and the size of the smallest. There are five sizes, which receive their numbers from the calibre of the tube, expressed in millimeters, — 3, 4, 5, 6, and 7. Professor Zaufal proposes to have in addition a number 2, as it occasionally happens that number 3 cannot be introduced.

They are made of German silver (*Neusilber*), or hard rubber, 11 centimeters (4½ inches) in length. The numbered circles are intended to represent the small ends, but are all a little too large. The metal speculum is thinner than that of the same number made of hard rubber, consequently for the same external size a greater internal diameter and view can be obtained, — a point of much importance. They are polished internally, in consequence of which the illumination is much better. The hard rubber speculum is lighter and sometimes more agreeable to the patient, but the light is not so good and the surface seen is smaller; but on the other hand it is not injured by chemicals, nor heated by the galvano-cautery. These instruments are not intended to supplant the rhinoscopic mirror, but to supplement it; for it must be distinctly borne in mind that there are cases in which they cannot be introduced on account of narrowness or crookedness of the inferior nasal passages, and also cases in which the rhinoscopic mirror cannot be used on account of want of self-control on the part of the patient, or structural conditions that may entirely prevent its use.

Before attempting to introduce for the first time one of these specula, an inspection of the anterior nasal passages should be made, for which there is probably no better instrument than Charrière's dilating bivalve speculum. This preliminary examination will show the position of the septum narium, of the inferior and middle turbinated bones, and the width of the nasal passages. It may also show that the posterior wall of the pharynx is visible, though it is seldom so much so as to render the speculum useless. Thus we obtain important data, and are enabled to choose the instrument most likely to pass into the naso-pharyngeal space. This, if of metal, is to be warmed slightly before introduction, for the greater comfort of

the patient, and to prevent the condensation of the moisture of the breath upon its polished interior surface and the consequent obstruction of the view.

Professor Zaufal does not use any lubricating material, but the writer finds that a small quantity of vaseline smeared upon the outside of the speculum facilitates its introduction. The aural or laryngoscopic mirror with head-band is used, and for illumination either ordinary daylight or such source of artificial light as may serve for the ear or larynx. The greatest gentleness of manipulation is requisite, to avoid giving pain or injuring the mucous membrane. By gently rotating the speculum as it advances, and by following the end with the eye, it may be made to avoid projecting points and to displace swollen tissues. If it is in the inferior meatus the end must be kept along its floor, and should not be allowed to press against the septum. In some cases the inferior meatus is impassable, but the middle may give sufficient room for the tube. When this is the case care must be taken not to depress the external end too much. The view obtained by this latter method is not so satisfactory usually as that by the inferior meatus. It is proper to commence with one of the smaller sizes; 3, 4, and 5 will be found those most generally useful. Either of these presents a very small field, but it is seen *direct* and erect, and by various movements, which the parts will usually permit, a quite large surface may be inspected, consisting of one half the posterior wall of the upper pharynx with the pharynx tonsil, Rosenmüller's fossa, the mouth of the Eustachian tube, and the roof of the soft palate or levator veli palati. But in order to recognize these objects movements must be obtained. This is accomplished by phonation; the patient or subject is directed to make the vowel sounds; the *e* long drawn out gives the best results. One sees then the levator veli palati move directly upwards; the inner or posterior lip of the Eustachian tube, the plica salpingo-pharyngea, moves up and inward; the outer lip of the tube, the plica salpingo-palatina, — called also the tensor palati, the dilatator or abductor of the tube, — moves slightly downward. These three

(3) parts inclose the ostium tubæ, which is recognized as an opening pointing outward, but is seen in profile and not looked into directly.

Is it necessary to detail the advantages of this view of the mouth of the Eustachian tube to an otologist? Do you question whether there is a practical advantage in being so very easily able to make applications under the guidance of direct vision to the parts thus brought into view? Caustics can be applied to thickened tissues, new growths, or ulcers; the galvanocautery is used by Professor Zaufal constantly to destroy small adenoid granulations, or to reduce thickenings of the tissues. For this purpose the speculum is pushed against the part to be cauterized, which is in full view, so as to isolate it from neighboring parts; the electrode is introduced and placed in contact with the surface; the poles are closed for an instant; a crackling sound is heard; the electrode is drawn away, and the circuit broken. A small eschar is seen when the smoke is blown out. This can be repeated on as many points as it is desired to burn; no neighboring part is affected, and there is no possible soiling or fouling of the apparatus by the mucus, etc., of the nose and throat.[1]

The eschar made has very little depth. Owing to the high degree of heat used and the low degree of sensibility in the parts, there is almost no pain felt. These applications are repeated about once a week. Small granulations may be thus removed; large ones, if pedunculated, are removed by means of a long-armed Blake's snare, which Zaufal has modified for this purpose. The Eustachian bougie may be introduced under ocular guidance. The movements of the mouth of the tube and the neighboring parts during swallowing, speech, etc, have been carefully studied by Professor Zaufal.

In order to learn this method it is advised that the parts be specially studied upon the half-head, either fresh or preserved

[1] Compare this method with one described in the *Medical Record*, December 30, 1876, by Dr. R. P. Lincoln, who introduces the electrode from below. It is provided with a circular protecting shield and spiral spring, on which the secretions of the parts must collect, making perfect cleanliness impossible.

in alcohol. The speculum can then be introduced with facility, its movements seen, and what can be done by this means easily understood, much more readily than if they are first attempted on a patient, when there is apt to be so much motion of the parts that the unpracticed eye recognizes nothing. But as the speculum may remain in position almost indefinitely, an immense advantage that it possesses over the rhinoscopic mirror, all the time needed can be taken for careful study. The long *e* should be sounded in a low tone, when the movements already described occur.

It is not intended to go fully into all the uses of these most valuable instruments. Enough has been said to show what may be done by their aid.

Priority of invention is now awarded to him who first publishes his work to the world. Dr. R. F. Weir, of New York City, about ten years ago inspected the naso-pharyngeal space by means of tubes (not funnel-shaped) introduced through the inferior meatus of the nose, but unfortunately he did not push his invention to practical results, nor publish what he had done. Therefore the world will speak of Zaufal's specula, and, *in time*, otologists will thankfully use them.

The writer must express his surprise that these instruments have as yet received so little attention from our American writers. Burnett, whose "Treatise on the Ear," Philadelphia, 1877, is the last new work on this subject published in the United States, on pp. 411, 412, under the head of treatment of chronic catarrh of the middle ear, says: "Great benefit may result from making various applications to the mouth of the tube (Eustachian), but no further inward . . . . Much good may be thus done by touching the faucial region of the tube with nitrate of silver," but absolutely no mention of Zaufal's specula is made in this chapter. They are only spoken of in connection with the movements of the mouth of the Eustachian tube, on p. 117, as "long funnels armed with mirrors, introduced into the nares, and passed back into the naso-pharynx."

I am sorry to say that Roosa, in the fourth (1878) edition of his excellent "Treatise on the Diseases of the Ear," does not mention these specula.

The writer then introduced metal speculum No. 3 into his own left nostril, and demonstrated to the members present the naso-pharyngeal space, the mouth of the Eustachian tube, and the movements that he had just described.

TRANSACTIONS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

TWELFTH ANNUAL MEETING.

Newport, R. I., July 23, 1879.

VOL. 2. PART 3.

BOSTON:
A. WILLIAMS & CO., 283 WASHINGTON STREET.
1879.

NEW BEDFORD:
PRINTED BY THE MERCURY PUBLISHING COMPANY.

CONTENTS.

PAGE.

Members of the American Otological Society..... 287
Minutes of the Twelfth Annual Meeting (1879)..... 289
Report on the Progress of Otology.
I. Anatomy and Physiology. By J. J. B. Vermyne..... 295
II. Pathology and Therapeutics. By D. Webster 322
Case of Menière's Disease following Parotitis. By H. D. Noyes.. 342
Contribution to the Pathology of the Temporal Bone. By Thos. R. Pooley..... 343
Trephining the Mastoid in a Case of Acute Suppurative Otitis Media; unusually rapid recovery. By H. Knapp..... 350
Facial Paralysis accompanying Purulent Inflammation of the Middle Ear. By C. J. Blake 353
A Case of Supernumerary Auricle of Rudimentary Development. (Polyotia.) By H. Knapp 357
On the use of Permanganate of Potassa in Chronic Otorrhœa. By Lucien Howe 359

MEMBERS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

HONORARY MEMBERS.

PROF. ALFRED M. MAYER.....Hoboken, N. J.
PROF. OGDEN N. ROOD.....New York, N. Y.

MEMBERS.

DR. FRANK W. ABBOTT.....Buffalo, N. Y.
DR. CORNELIUS R. AGNEW.....New York, N. Y.
DR. EDWIN W. BARTLETT.....Milwaukee, Wis.
DR. ROBERT M. BERTOLET.....Philadelphia, Pa.
DR. CLARENCE J. BLAKE.....Boston, Mass.
DR. ALBERT H. BUCK.....New York, N. Y.
DR. CHARLES H. BURNETT.....Philadelphia, Pa.
DR. JOHN H. DIX.....Boston, Mass.
DR. EZRA DYER.....Pittsburg, Pa.
DR. RUDOLPH GEBSER.....New York, N. Y.
DR. JOHN GREEN.....St. Louis, Mo.
DR. J. ORNE GREEN.....Boston, Mass.
DR. EMIL GRUENING.....New York, N. Y.
DR. J. H. HINTON.....New York, N. Y.
DR. EDWARD L. HOLMES.....Chicago, Ill.
DR. LUCIEN HOWE.....Buffalo, N. Y.
DR. SAMUEL J. JONES.....Chicago, Ill.
DR. CHARLES J. KIPP.....Newark, N. J.
DR. HERMAN KNAPP.....New York, N. Y.
DR. WILLIAM S. LUDLUM.....Morris Plains, N. J.
DR. ARTHUR MATHEWSON.....Brooklyn, N. Y.
DR. C. S. MERRILL.....Albany, N. Y.

Dr. H. G. Miller ..... Providence, R. I.
Dr. Henry D. Noyes ..... New York, N. Y.
Dr. J. F. Noyes ..... Detroit, Mich.
Dr. Charles I. Pardee ..... New York, N. Y.
Dr. Oren D. Pomeroy ..... New York, N. Y.
Dr. Thomas R. Pooley ..... New York, N. Y.
Dr. J. S. Prout ..... Brooklyn, N. Y.
Dr. William Rankin ..... Newark, N. J.
Dr. Charles E. Rider ..... Rochester, N. Y.
Dr. D. B. St. John Roosa ..... New York, N. Y.
Dr. John D. Rushmore ..... Brooklyn, N. Y.
Dr. William W. Seely ..... Cincinnati, O.
Dr. Samuel Sexton ..... New York, N. Y.
Dr. Henry L. Shaw ..... Boston, Mass.
Dr. Francis Simrock ..... New York, N. Y.
Dr. Nelson B. Sizer ..... Brooklyn, N. Y.
Dr. H. N. Spencer ..... St. Louis, Mo.
Dr. George T. Stevens ..... Albany, N. Y.
Dr. George Strawbridge ..... Philadelphia, Pa.
Dr. Charles A. Todd ..... St. Louis, Mo.
Dr. William Thomson ..... Philadelphia, Pa.
Dr. J. J. B. Vermyne ..... New Bedford, Mass.
Dr. David Webster ..... New York, N. Y.
Dr. E. Williams ..... Cincinnati, O.

THE AMERICAN OTOLOGICAL SOCIETY.

MINUTES FOR 1879.

NEWPORT, R. I., *July* 23, 1879.

The Society met at the Aquidneck House at 10.45 A. M., Dr. A. H. Buck, the President, in the chair.

Present :—

DRS. A. H. BUCK	New York.
JOHN GREEN	St. Louis.
DAVID WEBSTER	New York.
J. J. B. VERMYNE	New Bedford, Mass.
O. D. POMEROY	New York.
C. J. BLAKE	Boston.
CHAS. J. KIPP	Newark, N. J.
H. KNAPP	New York.
H. D. NOYES	New York.
T. R. POOLEY	New York.
GEO. STRAWBRIDGE	Philadelphia.
J. S. PROUT	Brooklyn.
J. F. NOYES	Detroit.
E. DYER	Pittsburg, Pa.
H. G. MILLER	Providence, R. I.
GEO. T. STEVENS	Albany.
J. ORNE GREEN	Boston.
J. H. DIX	Boston.

And by invitation :—

DRS. J. A. ANDREWS	Stapleton, S. I.
E. HUTCHINSON	Utica, N. Y.
S. THEOBALD	Baltimore, Md.
A. G. HEYL	Philadelphia.
E. E. HOLT	Portland, Me.

The President appointed as the Business Committee, Drs. Prout, Strawbridge, and John Green.

On motion, the gentlemen present by invitation were invited to take part in the proceedings.

The minutes of the Second Session of the last meeting were read and approved.

The Treasurer's Report was read and referred to Dr. Webster, as the Auditing Committee.

The Committee on Membership made a report recommending the election of

DR. LUCIEN HOWE, of Buffalo, N. Y.,

and on ballot he was elected.

The resignation of Dr. Robertson, of Albany, was read and accepted.

The following nominations for Membership were then read: —

DR. EDWARD T. ELY, of New York,
By Drs. Roosa and Prout.

DR. R. E. BRANDEIS, of New York,
By Drs. Pooley and Knapp.

DR. SAMUEL THEOBALD, of Philadelphia, Pa.,
By Drs. Burnett and Strawbridge.

DR. J. A. ANDREWS, of Stapleton, S. I.,
By Drs. Webster and Agnew.

DR. READ J. MCKAY, of Wilmington, Del.,
By Drs. Webster and Agnew.

DR. E. E. HOLT, of Portland, Me.,
By Drs. Pomeroy and Webster.

and for Honorary Membership: —

PROF. ALEXANDER GRAHAM BELL, of Cambridge, Mass.,
By Drs. Blake and J. O. Green.

The Auditing Committee reported the Treasurer's accounts correct, and his report was accepted.

The Business Committee reported the following Order of Business: —

1. Report on the Progress of Otology.

I. Anatomy and Physiology. By Dr. J. J. B. Vermyné.

II. Pathology and Therapeutics. By Dr. D. Webster.

2. Clinical Remarks upon Fifteen Hundred Consecutive Cases of Ear Disease. By Dr. C. R. Agnew, by title.

3. Case of Menière's Disease produced by Metastasis of Parotitis. By Dr. Henry D. Noyes, by title.

4. Contributions to the Pathology of the Temporal Bone. By Dr. T. R. Pooley.

5. Facial Paralysis accompanying Purulent Inflammation of the Middle Ear. By Dr. C. J. Blake.

6. Trephining the Mastoid in a Case of Acute Suppurative Otitis Media. Unusually Rapid Recovery. By Dr. H. Knapp.

7. Exhibition of a Cochlea discharged from the ear of a child two years old. By Dr. John Green.

8. Exhibition of a Sarcoma of the Auditory Nerve. By Dr. George T. Stevens.

9. A Case of Supernumerary Auricle of Rudimentary Development. By Dr. H. Knapp.

10. On the Treatment of Certain Forms of Diffuse External Otitis. By Dr. C. J. Kipp.

11. On the Use of Permaganate of Potassa in Chronic Otorrhœa. By Dr. Lucien Howe, by title.

These papers were read in order, discussed, and each in turn referred to the Publishing Committee.

Dr. H. D. Noyes gave notice of a proposed change in the By-Laws, viz.: that the last paragraph of Section II. Election of Members, beginning, "Ten days before," etc., should be entirely omitted.

At 2.30 P. M., after the reading of the eleventh paper, the Society adjourned to 7 o'clock P. M.

Second Session.

The Society was called to order at 7.10 P. M., Dr. Buck in the chair.

The minutes of the first session were read and approved.

Verbal communications were then called for.

Dr. Buck showed an improved nozzle for the aural douche, the object of which was to ensure more thorough cleansing and to prevent injury to the ear from inserting the point too deeply in the meatus. This is effected by means of projections of hard rubber.

Dr. John Green made some remarks on the use of Chromic Acid in the treatment of the stumps of polypi.

Dr. H. D. Noyes asked the experience of members in the use of Hydrobromic Acid for Tinnitus Aurium; in his own experience its effect is absolutely negative. By the use of combinations of the various Bromide Salts, continued for some time, he had however obtained a gradual relief to the noises in some cases of Otitis Media, with intense subjective noises and a hopelessly impaired hearing.

Dr. J. F. Noyes had seen benefit from Hydrobromic Acid in only one single case.

Dr. Webster said that the acid had been much used at the Manhattan Eye and Ear Hospital, and he had only seen benefit in one case.

Dr. J. O. Green had been unable to obtain any benefit from it in a considerable number of cases where it had been used.

Dr. Prout showed a punch for making artificial membranæ tympani, and a pair of Grüber's forceps for applying the membranes.

The amendment of the By-Laws, proposed by Dr. H. D. Noyes at the morning session, was then discussed, and it was decided that the last paragraph of Section II. Election of Members, beginning with the words, "Ten days before," etc., should be entirely omitted.

Dr. Webster moved that the Report on the Progress of Otology, as heretofore published in the Transactions of the Society, be hereafter dispensed with. Carried He also moved that the Secretary of this Society be authorized to

secure the services of a stenographer, who is a physician, to report the discussions of the Society, and that the same be printed in the Transactions. Carried.

Dr. John Green moved that members who have made verbal communications at the present meeting, be requested to put the same in writing, to be sent to the Secretary before September 15th. Carried.

Dr. H. D. Noyes moved that the Reports on the Progress of Otology be referred to the Publishing Committee, with the request that said Reports be condensed, as far as may be practicable, before printing them in the Transactions. Carried.

Dr. J. O. Green moved that about June 1st of every year the Secretary request members to send him the subjects of the papers which they propose to read before the Society; that these subjects be incorporated with the notifications of the meeting, and that at the meeting such papers as have been previously thus announced shall take precedence. Carried.

The Business Committee reported the following list of officers for the ensuing year, and they were elected:

President	Dr. A. H. Buck.
Vice President	Dr. C. H. Burnett.
Secretary and Treasurer	Dr. J. J. B. Vermyne.
Committee on Publications	Dr. J. J. B. Vermyne, Dr. C. J. Blake. Dr. J. O. Green.
Committee on Membership	Dr. C. J. Blake, Dr. H. D. Noyes, Dr. Geo. Strawbridge

The Committee further stated, that at the urgent request of Dr. J. O. Green, the Secretary of the Society, his name had not been proposed for re-election, and proposed a vote of thanks to Dr. Green for the zeal and faithfulness displayed in the performance of his duties as Secretary of the Society since its origin. This vote was passed unanimously.

The customary resolutions in regard to adjournment, place of meeting and revision of proofs were then adopted, and at 9 P. M. the Society adjourned.

J. ORNE GREEN, *Secretary.*

REPORT ON THE PROGRESS OF OTOLOGY.

(*July* 1*st*, 1878—*July* 1*st*, 1879.)

PART I.

ANATOMY AND PHYSIOLOGY.

By Dr. J. J. B. Vermyne, *of New Bedford, Mass.*

Anatomy.—Moos contributed in the Archives of Opthalmology and Otology an interesting article on the blood-vessels of the membrana tympani. He refers at first to his communication on this subject in the same Archives of 1869, when having discovered blood-vessels in the substantia propria of the drum-membrane, he considered them pathological, especially since all authors, Wharton Jones, Arnold, Toynbee, Gerlach, Henle, Politzer and Prussak had unanimously and explicitly denied the presence of blood-vessels in the substantia propria of the drum-membrane. Next, he mentions the researches of Kessel, proving the presence of blood-vessels, which was later again denied by Henle. He gives in this article the results of a new series of investigations, which are briefly stated thus: The cutis over the short process of the malleus has but a scanty supply of blood-vessels. The zones of the substantia propria of the membrana tympani, situated immediately between the manubrium and the periphery, possess numerous perforating vessels of a venous nature, and which, in so far as concerns the circulation of the blood in the membrane, form a not unimportant union between the veins of the cutis and these of the mucous membrane. Moos confirms the appearance of looped vessels on the surface of the mucosa of dogs, cats and rabbits, as described by C. H. Burnett, and states

finally that the blood can flow from the tympanum to the external auditory meatus in three ways:

1. Along the whole periphery of the annulus.

2. Along the manubrium mallei through Shrapnell's membrane.

3. By means of perforating veins in the intermediate zones of the substantia propria membranæ tympani.

While sawing through the pyramid of a left petrous bone, the section being made at right angles to the long axis, and close behind the oval window, Steinbrügge found a noticeable excavation of the wall of the labyrinth, which extended beneath the canal for the facial nerve, almost to the ampullar end of the frontal and the posterior end of the horizontal semicircular canal. The existence of this excavation being unknown to him, he examined thirty-seven petrous bones and found the sinus present in thirty-five, while it was reduced to a shallow and irregular groove in two cases, which exhibited traces of previous inflammatory processes in the tympanum and mastoid cells. The sinus lies backward of the round and oval windows, and nearly central, but always somewhat higher than the round window. The anterior and lower edge is formed by the posterior side of the triangle which surrounds the entrance to the cochlea, the posterior boundary is represented by the eminentia pyramidalis. The form of the entrance is sometimes oval and sometimes horse-shoe shaped. The average height is 4.3 Mm.; average depth 3 Mm. J. F. Heucke, in describing the wall of the labyrinth (1820) says: "The space between the triangular eminence, the promontory and the oval window forms a distinct excavation, the sinus tympani." Steinbrügge has retained this latter name for the excavation he has described.

Krause gives a description of the glandula tympanica in the human ear. It is a swelling of the n. tympanicus, spindle shaped, 4 Mm. long and 1 Mm. thick, within the canaliculus tympanicus, and consists of a framework of connective

tissue, very rich in blood-vessels, with elastic fibres, pale and nucleated nerve-fibres from the tympanic nerve and some ganglion cells between the latter, further with pyramidal or stellate perithelium cells, some of which contain pigment, and forming regular groups around the blood-vessels. Krause considers this glandula tympanica to be a rudiment of the lining of the first branchial arch or of the future mucous membrane of the tympanum, and was actually able to demonstrate a direct connection between a fold of the mucous membrane and the glandula, in two cases; one an embryo of six months, and the other an adult.

The fissura mastoidea-squamosa, which is constantly found in the temporal bone of infants, as a distinct groove at the junction of the mastoid with the squama is, according to Kirchner, often found persistent in youth and even in aged people. In 300 skulls of adults, the fissure was found entirely complete on both sides in 5 per cent.; left complete, right partial fissure in 2.6 per cent.; left complete fissure, right nothing in 1.6 per cent.; right complete, left partial fissure in 1.3 per cent.; partial fissure on both sides in 6.6 per cent.; left partial fissure in 4 per cent.; right partial fissure in 2 per cent. These figures show that in most cases, the fissure is found on both sides. Among the skulls examined, where the fissure was found, were three belonging to ages 68, 70 and 83 years. Kirchner further communicates a case observed by Wiedersheim, in which the fissure formed such a groove that the mastoid process had the appearance of being double.

Zuckerkandl contributes an article on the anatomy of the mastoid process, and more especially in regard to the pneumaticity of this part of the organ of hearing. Two hundred and fifty temporal bones were examined. In general, the external appearance of the mastoid does not give any reliable indication of the internal condition. He distinguishes seven different conditions of pneumaticity, depending upon the more or less extent of the air cavities as a

whole or of the single air cells, and their comparative extent in different parts of the bone, and four conditions of the appearance of diploe in the cells of the bone. Of the 250 temporal bones examined, 100 were fresh and 150 macerated. In the first, the mastoid process was entirely pneumatic in 40 cases; in 22 cases, the process contained up to the antrum a red or yellow adipose tissue (diploe); in 9 cases, the lower half of the process was diploetic, the upper half pneumatic, and in the remaining 29 cases only the point of the process contained narrow diploetic cells to an extent of 3-5 Mm., while the rest was pneumatic. Sometimes both varieties would be found in the same person, one mastoid process being entirely or almost entirely diploetic, the other pneumatic. In the macerated bones, the process was entirely occupied by pneumatic cavities in 52 cases; in 20 cases, the lower half was spongy or diploetic, the upper half pneumatic; in 38 cases, the point of the process was diploetic to an extent of 3-5 Mm.; in 7 cases, the spongy substance was confined to the fars petrosa; in 4 cases, the point was to an extent of 3-5 Mm. compact. In the remaining 29 cases, the process was entirely spongy up to the mastoid antrum. Hence, it follows that the process is entirely pneumatic in 36.8 per cent., entirely diploetic in 20 per cent., while in the remaining cases pneumatic and diploetic cavities appear together.

Vulpian made a communication before the "Académie des Sciences" on the chorda tympani. According to some anatomists, it is derived from the portio Wrisbergiana of the n. quintus, according to others from the n. facialis. He made his experiments on dogs, and found that when the n. facialis was divided at its entrance in the meatus auditorius internus, or a little nearer its origin, beneath the fundus of the ventriculus quartus, the chorda tympani was not affected, although the peripherical branches of the facial nerve became atrophied. If he could succeed in severing the n. trigeminus within the cranium without injuring the facial

nerve, the fibres of the chorda were always altered. He states that, whenever the n. massetericus has undergone any change, the nerve fibres of the chorda will always be found to have suffered, and hence attributes its origin to the n. quintus.

Kuhn describes the membranous labyrinth of bony fishes. See Review in Arch. of Opth. and Otol., vii, 1.

While noticing in our last report the investigations of Weber-Liel on the aquæductus vestibuli, mention was also made of his opinion that the aquæductus cochleæ formed the communication between the perilymphatic spaces of the labyrinth and the arachnoid cavity. In a recent article, he formally denies that this aquæduct only serves for the passing of a vein, conveying the blood from the cochlea to the jugular vein. It does not open outside the cranium, but it belongs to the middle cerebral fossa and stands in connection with the sub-arachnoidal sinus, which extends between the cerebellum and medulla oblongata. He states that, although in the macerated skull the relation of the entrance of the aquæductus cochleæ to the foramen lacerum posterius might justify the opinion thus far generally held, this relation becomes entirely different when the parts are still covered by the dura mater. It will then be seen that the bony entrance of the aquæductus cochleæ shows two folds of the dura, one above the other, crescentic in shape and extended over two canals, which are open to view for a little distance and the upper one of which is the real entrance to the aquæduct. By this duplicature of the dura mater, which extends from the edge of the jugular foramen to the occiput and separates the cranial cavity from the underlying parts, the connection of the aquæduct with the middle cerebral fossa is made. The intracranial entrance of the aquæduct leads in two separate canals, as could be proved by aspirating fluid colored with Beale's blue. For this purpose the superior semi-circular canal was opened; a small glass tube was hermetically fixed over the opening and further

connected with a rubber tube, and the latter again with a Wymann's stomach-pump. When forcing the air with this instrument in the labyrinth, the saccus endolymphaticus on the posterior side of the petrous bone became inflated and a few drops of fluid, mixed with air, escaped through the intracranial opening of the aquæductus cochleæ. If now the colored fluid was applied to this latter opening, and by reversing the action of the apparatus it was used as an aspirator, after a few suctions the fluid would ascend in the little glass tube. If the sinus sigmoideus was filled, he succeeded in 6 cases out of 10 in thus filling not only the aquæductus, but also a small vein, which runs in a separate bony canal to the scala tympani. Weber-Liel embodies the result of his investigations in the following sentences:

1. The aquæductus cochleæ is not a venous canal, but a free canal lined with a continuation of the dura mater, connecting the scala tympani with an intracranial space.

2. From the vena jugularis a small vein ascends and enters, in the anterior part of the aquæductus cochleæ, in an aperture in the bone. This opening forms the entrance to a peculiar bony canal, which is separated from the aquæduct proper by a long ridge, nearly 1 Mm. broad, running almost parallel with the latter, toward the scala tympani, gradually approaching the aquæduct and ending in a separate opening, nearly $\frac{1}{3}$-$\frac{1}{4}$ Mm. distant from the opening of the aquæductus cochleæ.

It must, however, here be stated that, among others, Hasse, in 1873, in "Die Lymphbahnen des inneren Ohres der Wirbelthiere," speaks of the canalis perilymphaticus, which opens through the apertura aquæductus cochleæ and conveys the perilymph from the auditory capsule to the periphery, where it empties in the epicerebral lymph chamber, and that Burnett, in his "Treatise on the Ear," speaks of the aquæductus cochleæ as the important exit of the perilymph of the labyrinth, and not as serving for the passage of a vein.

Rüdinger found that the fibres of the muscles which enter in the velum palatinum make numerous crossings, and this not only of the corresponding muscles of opposite sides, but also of the upper and lower muscles of the same side. The m. azygos encloses at some places acinous glands within its bundles. At the anterior and inferior side of the velum palatinum he also found a musculus azygos uvulæ inferior.

In applying the so-called "Corrosions Anatomie" to the examination of the ear, Bezold has injected the cavity of the middle ear with a colored mixture of resin and wax, and exposed it to corrosion in muriatic acid, with incomplete result. After boiling the preparation for a short time in the corrosive fluid, so that the air could escape, he succeeded in obtaining very complete casts. For the examination of the organ of hearing in small animals, Flesch recommends a mixture of osmic and chromic acid in distilled water. In a very short time, two or three days, the parts are ready for further preparation for microscopical examination, and may thus be preserved for a number of years.

Physiology.—In an article on the development of the central nerve-system in the Teleostei, Götte states that a shield-like thickening of the ectoderm, the axial plate, is the common origin of the central nerve-system and the terminal apparatus of the three higher organs of sense. Contracting on both sides toward the median line, it separates in its entire length in three parts—a single middle part and adjacent flat lateral parts. The development is stronger in the head than in the trunk. While in the trunk the lateral parts, gradually and without distinct limits, unite with the central part, within the head they continue separately as sensorial plates. In the posterior part of the head the sensorial plate separates itself entirely from the brain and the cutis, and thus forms the otic vesicle.

In our last report, we had occasion to refer to the investigations of Urbantschitsch on the development of the middle ear and Eustachian tube. He states that the middle ear

and tube are derived from the common naso-oro-pharyngeal cavity, and that their lining membrane is a part of the external blasto-dermic membrane. In a former article, Moldenhauer attributes the origin to the visceral cavity of the fœtus, and considers the lining membrane as formed by the internal or visceral layer. He has recently repeated his examinations in connection with Rauber, confirming his former statements. He refutes the opinion of Urbantschitsch, not only on the ground of his own researches, but also because in the illustration from Schenck, "Lehrbuch d. vergl. Embryologie der Wirbelthiere," upon which Urbantschitsh had really based his conclusions, (Embryo of Bufo cinereus) the oral and visceral cavity had already united by the absorption of a part of their separating walls, and that the point of separation between these cavities lies at the origin of the tongue, in front of the sulcus tubo-tympanicus. Other examinations were made on transverse sections of the embryo of chickens from two to five days old, and in mammals, where the primitive tubo-tympanic cavity is represented only by a blind sac from the intestine, projecting between those parts of the ear, which are undoubtedly formed by the ektoderm, namely, the external meatus and labyrinth. Moldenhauer believes that the determination of this point of origin is not only of morphological, but also of practical importance. For if this origin lies in the naso-oro-pharyngeal cavity and the lining membrane is derived from the ektoderm, the diseases of the middle ear and Eustachian tube belong, properly speaking, to the skin diseases, otherwise to diseases of the intestines. He points to the analogous fact that the histo-genetic relation of the skin and the lens of the human eye explains the relation existing between some diseases of the former and some accompanying changes in the latter.

In the human embryo of 2 and 3 months, Urbantschitsch finds the form of malleus and incus entirely developed, still cartilaginous. In microscopic sections, parallel to the lon-

gitudinal axis, he finds a partial confluence of both ossicles, especially in the region of the future lower joint. In colored preparations, a more vividly tinted line of demarcation indicates the place of separation, and the cartilage cells show a more regular arrangement in opposite columns.

Grüber also finds, in a certain stage of development, the ossicles forming one single bone, in which subsequently the formation of a joint appears. The first indication of this joint occurs between the lower end of the descending branch of the incus and the head of the stapes. There appears an intercalary cartilage, and the form of the articulation begins to be marked out, just as it has been described in entirely developed individuals by Rüdinger. Grüber asserts that the part of the roof of the tympanum, which in adults is formed by the horizontal part of the temporal squama, develops from an entirely different substance from the rest of the tympanic cavity. And lastly, that the tympanum must not be considered, like the Eustachian tube, as a continuation of the oral cavity, but that for the greatest part it is formed by rarefaction and resorption of the original fundamental substance, the same as the mastoid cells. In this cavity subsequently opens the Eustachian tube from the throat.

Gellé contributes an article on the gelatinous mass filling the middle ear during uterine life. See Review in Amer. Journ. of Otol., I.

In an article on the formation of sequestra in the mastoid process of the child, Hartmann speaks of the development of the mastoid cells in the early years of life, and the influence of this development in the formation of sequestra in inflammation. While it is generally believed that the development of the cell cavities of the mastoid takes place by rarefaction of the cancellous bone, after which only the partition walls of the cells remain, Hartmann holds the opinion that this rarefaction only plays a secondary role, but that the collective space of the cavity first enlarges, and that next

the cell system is developed by a formation of partition walls from the inner surface, which spread in all directions and unite.

Loewe has investigated the development of the cartilaginous and osseous labyrinth in rabbit embryos of 7 to 8 Mm. length. See Report on Progress of Otology in Arch. of Otol., viii.

Pritchard presented at the meeting of the British Medical Association in August, 1878, a paper on the development of the organ of Corti. See Review in American Journal of Otology, I.

A case of microtia was reported by Bürkner, in a little girl 7 weeks old. The left auricle, 2.5 Cm. high, was twisted up on the concave side to a roll of 1-1.5 Cm. breadth. In the place of the concha was a small groove, 2 Mm. deep and closed by two folds. Two smaller grooves corresponded with the fossa intercruralis and the incisura intertragica. Meatus absent. Right ear normal.

Kirk Duncanson gives the case of a patient with rudimentary auricle, which presented itself as a longitudinal elevation of the skin, upon which was a process corresponding to the lobule, and in place of the external auditory canal a simple depression. Hearing was absent.

H. Schwartze gives some excellent illustrations of congenital defects of the auricle and atresia of the meatus. In regard to the ossification gap of the external auditory canal, he says: In childhood, up to the fourth year, an ossification gap, closed merely by connective tissue, is found normally in the anterior lower wall. In adults, this opening is found in exceptional cases.

Bürkner gives a detailed description of three skulls, in which the hiatus ossificationis of the external meatus was, in form and size, more equal to the stage usually found in children. As two of these skulls belonged to persons whose development had generally suffered—one being a man of 40 with the habitus of a youth from 14–16, the other a cre-

tin—Bürkner believes that this may serve to explain both the presence and form of the gap, and that especially among such classes a large hiatus, corresponding with that of infants, may often be found.

In the posterior wall of the external meatus Zuckerkandl found a fissure in three petrous bones. See Review in Arch. of Otol., viii.

The presence of formal defects in the tegmen tympani was the subject of an interesting paper by Bürkner, an extract of which appeared in the Report on the Progress of Otology for last year. Bürkner holds the opinion that these defects result from absorption by pressure, and are generally found in connection with similar defects in the roof of the orbit and with deep impressiones digitatæ and large juga cerebralia. He has since contributed another article to the literature of this subject, in which he gives the results of further investigations on 92 skulls. The result was the same as with his former researches. Of the whole number, 41 showed the defect in the tegmen tympani; and of this number, 73.2 per cent. had the same defect in the roof of the orbit, and in 60.7 per cent. the juga cerebralia were largely developed.

Jaenicke considers the defects in most cases as congenital, attributes some to senile atrophy, and entirely rejects Hyrtl's opinion in regard to the influence of gravidity. He bases his theory upon the complications usually found in connection with these defects, as rarefication of other parts of the basis cranii, vitreous appearance of the tegmen, round edges of the perforations, its existence in childhood, and especially its frequent occurrence with extensive development of the frontal sinus.

Flesch, in another article, after quoting the contributions of Bürkner and Jaenicke, gives a detailed account of 11 skulls, which he thought of more peculiar interest to the question. Most authors believe the perforation to be acquired; Jaenicke thinks it is congenital. Of those who be-

lieve it to be acquired, some, like Hyrtl and Von Tröltsch, attribute it to pressure from the tympanum; others, like Bürkner, to pressure from the substance of the brain. Flesch ranges himself on the side of the latter, and tries to explain why the roof of the orbit and the tegmen tympani should be, by preference, the seat of perforations. The frequent presence of deep impressiones digitatæ is here of great importance; for, according to Kölliker, they are the result of absorption from pressure. The same takes place in the tegmen tympani and the roof of the orbit, and, there being no compensating apposition, as there is in other places, this absorption leads to thinning and finally to perforation. In the eleven cases he describes, three show simple dehiscentia of the tegmen. In two of these cases there were also deep impressiones digitatæ; they are less developed in the third case, which has only one small perforation over the malleo-incudal joint. One of the cases shows also an opening of the upper semi-circular canal, which he accepts as a sure indication that the absorption proceeded from the base of the skull. One case shows especially the relation between perforations and impressiones, as the former appear at the bottom of the latter; in another case the impressiones were very deep, except at the temporal bone (where they were either absent or very shallow), and there was also no perforation of the tegmen. In one case the defect was evidently caused by granulation of the external surface of the dura mater; in two cases it was the result of an affection of the cavum tympani. In one of these there was only perforation of the tegmen; in the other, also, of the posterior surface of the petrous bone. One shows perforation as result of glandula Pacchioni, and one an apparent rarefication of the tegmen, with general larger development of the air-containing cavities of the skull. In consequence of these and Bürkner's investigations, Flesch opposes the congenital theory of Jaenicke. There certainly are perforations found in infants, but they do not resemble those of adults, and the process of

ossification in the temporal bone does not allow of an explanation of the origin of the defects as congenital. His general results are embodied in the following sentences:

1. Perforation of the tegmen tympani is a consequence of absorption; it is rarely a congenital malformation.

2. In a large majority of cases an increase of pressure within the cranial cavity is the cause of this absorption, and shows itself also in other places where no compensating growth by apposition can take place.

3. Extensive development of the pneumatic cavities, especially dilatation of the tympanum and the mastoid cells, favors the forming of perforations by rarefication of cortical bone substance.

Politzer considers the dehiscentia of the tegmen as possibly congenital, and the result of arrested development.

Schwartze calls it the most common of inherited irregularities. In some cases, instead of absolute gaps in the bony tissue, the roof of the tympanum contains cavities filled with gelatinous tissue.

Zuckerkandl describes three interesting cases of congenital malformation of the tympanum. See Review in Arch. of Otol., viii.

At a session of the Berlin Physiological Society, H. Munk made an interesting communication of a case of unilateral absence of the semi-circular canals in a pigeon. See Review in Arch. of Otol., viii.

The function of the auricle is, according to Politzer, of much less importance than was thought by more ancient writers. It is, however, not to be doubted, that it has a real influence upon the transmission of sounds to the drum-membrane, although not as much in man as in animals. It is especially the concha which collects a part of the sound-waves reaching the ear and reflects them in the meatus, the position of the tragus materially assisting in this function. The size of the auricle and its angle of insertion exert also some influence upon the reflexion of sounds into the meatus.

C. H. Burnett attributes to the cerumen a protective function in regard to aspergillus. In a canal which is sheathed with ear-wax, aspergillus is seldom found, and never in a flourishing condition, while in an ear invaded by aspergillus, cerumen is rarely if ever found in a normal quantity or condition.

The outward growth of the skin of the auditory canal, suggestive of the growth of a nail, to which Burnett attributes the removal of superabundant cerumen, has been adopted by Buck to explain a case of complete seclusion of the external meatus by a dermoid membrane. Starting from the movement observed in the scab of a paracentesis, he believes that this cuticle could represent a desquamation—probably the result of an acute congestion of the parts—of the entire epidermal coat of the drum-membrane. At a certain stage of this process there was probably first tension of the central part, and by the continual outward growth of the healthy cuticle, the exfoliated cuticular membrane was afterward lifted entirely off the underlying membrana tympani, until at last it became an independent diaphragm. If this view is right, it would also indicate that the rate of speed is the same for all parts of the canal, since a difference in rapidity of outward growth would have produced a rupture, or at least distortion of the seclusion.

Hensen has published some investigations on the action of the m. tensor tympani. The result of his experiments on a curarized dog, where the bulla ossea on one side was exposed and a needle introduced in the tensor tympani, was that every tone, every noise, every syllable brought the needle in motion. If the tone was continued, the needle became still; it seemed as if the muscle were relaxed. Every new noise produced this movement. Whistling some melody, whispering, snapping the fingers and creating a noise either near to or far from the ear were resorted to, but the muscle always acted the same. It appeared, however, that the action was a little more energetic when the noise was

very loud, while with a very light noise it was sometimes entirely absent. If the tones were emitted in rapid succession, the muscle, or at least the needle, never came quite at rest. It was strange that touching the membrana tympani secundaria, even the prick of a needle in the cochlea and nerve did not produce any observable contraction of the muscle, neither was it brought about by contact of the walls of the external meatus. Hensen concludes from his researches, that as under normal conditions of hearing no muscle tone is observed, the action of the tensor tympani, if it really participates in the act of hearing, is one of spasmodic, not tetanic contraction, which occurs probably at the beginning of the tone.

In regard to the physiology of the Eustachian tube, Politzer says that the canal is not constantly open. Its permeability varies with the individual, for in a number of cases a current of air takes place from the throat to the tympanum in quiet respiration, while in others swallowing or a more forcible expiration is needed to produce permeability of the tubes. The canal of the tubæ becomes patent during the act of swallowing, through action of the muscles, especially of the abductor tubæ. A difference of pressure is more readily assimilated in the direction from the tympanum to the throat than in the opposite direction.

Hartmann has determined manometrically the degree of pressure needed to inject air under various conditions of the tube. See Review in Arch. of Ophthalm. and Otol., vii.

He has subsequently collected these and other investigations in a monograph on the function of the Eustachian tube. The general results can be briefly expressed in the following sentences:

The least resistance to the passage of air in the tubes is experienced during the act of swallowing. It is less than in a condition of rest, in Valsalva's experiment and in phonation. Hence the Eustachian tube is opened by swallowing.

The opening of the tubes occurs during the first period of swallowing, at the moment of greatest contraction of the muscles. The latter opinion is based upon the fact, that if the movements necessary for deglutition are carried out until the palate is closed and then a condition of rest is again introduced, the passage of air within the tympanum can be distinctly observed.

Dennert had occasion to observe a patient, where in consequence of lues the nose had been almost entirely destroyed and in place of the tubal ridge and ostium and in most of the naso-pharyngeal cavity there was only smooth, white cicatricial tissue. The velum palati formed a stiff, unmovable bridge of this tissue to the posterior wall of the pharynx, thereby separating the nasal cavity hermetically from the pharynx. No movement of the soft parts could be observed in the naso-pharyngeal cavity during swallowing, and yet inspection of the membrana tympani showed distinctly on the left, less distinctly on the right side, an inward movement of the drum-membrane, followed by an outward movement. Closure of the nose did not affect any change in this symptom, and it could also be observed in a prop of mucus in a therapeutic incision of the membrane. These oscillations of the membrana tympani in a case of complete closure of the tubæ and total adhesion of the velum palati to the pharynx, are explained by Dennert as a dilatation of the volume of the tubes. The closure of the ostium prevented ventilation, but the widening of the tube produced a rarefaction of air within the tympanum, and hence the more pliable membrana tympani was moved inward as by suction.

Gradle contributes an article on the functions of the semicircular canals. See Review in Arch. of Ophthalm. and Otol., vii.

From the very extensive and often sharp review of Politzer's Lehrbuch by Grüber, in the "Monatsschrift für Ohrenheilkunde," we quote the following passage: As a matter of interest it may be mentioned that the author, speaking of

the painful sensation produced by tones and noises in many patients (hyperæsthesia acustica) writes: "In order to explain this fact, we shall probably be obliged to hold the opinion that the auditory nerve possesses fibres, which, when excited by sound-waves, create the sensation of sound, but that, together with these fibres, there also exists in the auditory nerve another kind of fibres, which are also excited by sounds, but do not give the sensation of sound, only a peculiar sensation of pain." According to this strange explanation, the auditory nerve should no longer be a pure nerve of sense, but a mixed nerve, with a character entirely its own.

MacDonald contributes in *Nature*, July 11, 1878, an article on the anatomy of the organ of hearing, in relation to the discovery of the principle of the microphone and magnophone, and more especially the relation of this principle to the function of the otoconia in vertebrata. See Review in American Journal of Otology, i.

The question whether the voice could be heard through the Eustachian tube when the conduction of sound through the external meatus has been interrupted, (which is denied by Voltolini), is answered in the affirmative by Politzer, who uses the following experiment. If in a person, with normal hearing power, both meatus are thoroughly closed, so that the voice can not be heard at 1 M. distance, it becomes audible when the earpiece of a diagnostic tube of the same length is inserted in one of the nostrils, the nose compressed over it and now the voice be emitted from the other end of the tube. Sexton observed a case where, when the patient performed phonation with mouth and nose closed, while the ear was connected with that of the observer through a diagnostic tube, the sounds were heard so plainly that he feels convinced there must be considerable aerial conduction through the Eustachian tube.

Thompson has instituted a series of investigations on the phenomena of binaural hearing, and especially for the pur-

pose of determining by Bell's telephone and tuning-forks, how the localization of sound is affected by its variations in respect to pitch, place, intensity and quality. See Review in American Journal of Otology, i.

Urbantschitsch found, in climbing a mountain, that every extensive movement of the head influenced the perception of sounds. For instance, the rippling noise of water was heard with less intensity at every inclination of the head, but distinctly and full when the head was erected. Each time the head was raised the sensation was that of large quantities of water pouring out. Examining the cause of this symptom, he arrived at the following results: Our ears perceive a continuous sound unchanged, when no extensive movement of the head is made. But if, while the trunk is at rest, the head be inclined forward, backward or to either side, there appears at once a change in the sound. If the body be inclined so that the head continues in the longitudinal axis of the trunk, only a slight change is perceived, which becomes immediately greater when the trunk is kept erect and only the head bent in the same angle as was formed by the inclination of head and trunk together. This leads him to believe that the symptom does not depend upon a change of position of the auricle in regard to the sound-source, as was stated by Mach. For the same symptoms can also be observed in strong depression of the lower jaw and in tension of the palatine muscles, although in these cases the position of the auricle in regard to the sound-source remains unchanged. Urbantschitsch believes that the latter, the tension of the muscles of the palate, is the most essential factor in producing the symptoms. Zaufal observed through his nasal funnel a distinct motion at the pharyngeal ostium of the tube, when the head was bent forward. Lucae found that in sudden forward inclination of the head, air would penetrate in the tubes with more facility, and Grüber observed the same in lateral inclination. Schwartze made the observation that often a snapping noise

is heard when the head is rapidly moved, and Politzer and Luschka explained this as caused by contraction of the tensor veli. Probably the same takes place in the symptom observed by Urbantschitsch, namely, tension of the muscles of the palate and pharynx; and subsequently of the tensor veli, followed by action of the tensor tympani muscle. In five cases, where tenotomy of the tensor tympani was performed, the difference in sound, caused by sudden movement of the head, was observable before, but not after the operation; showing the influence of this muscle in producing the symptoms.

In our last Report we noticed a communication from Kirk-Duncanson in the British Medical Journal of March 9, 1878, on the use of the electric telephone as a means of testing the hearing power. The principle proposed was to interpose a certain number of resistant coils in the conductor apparatus of any given instrument, and after determining the normal hearing power, to express any deficiency of hearing by the number of resistant coils, which had to be removed in order to make hearing possible. From a note in Politzer's Lehrbuch, p. 195, it appears, however, that the same was proposed by Hartmann at a meeting of the Berlin Physiological Society in its session of January 11, 1878. Hartmann, and after him Wodtke, have both written on this subject. See Report on Progress of Otology in "Archives of Otology," viii.

Galton describes a form of whistle for testing the hearing of high musical tones, which can be used as supplement to the tests with König's rods. See Review in Amer. Journ. of Otology, i.

Turnbull has repeated Blake's experiments with König's rods, and arrives at results somewhat higher than those obtained by the latter. The highest number observed varied from 60,000 and 55,000 to 25,000 v. s. He believes that some persons are naturally insensible to sounds above a certain pitch, which he expresses as "a kind of Daltonism of

the ear," and also that education of the ear greatly influences the rate of perception. Wherever in his examinations there occurred a difference in the two ears, it was generally in favor of the left.

A. M. Mayer proposes a new method for measuring the relative intensities of the sensations of sound. It consists in using the sound emitted by a closed organ-pipe of 512 v. s. in a special arrangement, described in the article. The distance where this sound could be distinctly observed should be considered as a unit for the hearing distance. Any patient suffering from deafness will not hear the sound at this unit, but at a fraction; which fraction at the same time expresses his amount of hearing.

C. J. Blake contributes a continuation of his former article on the use of the membrana tympani as phonautograph and logograph. Interesting is his refutation of one of the objections raised against the use of the human membrana tympani as phonautograph, nl., that the membrane and the ligaments of the ossicles become in time so changed by exposure as to be useless for phonautographic purposes. To this objection he gives the answer that the instrument, as first described by him, (1876) is still in use with the same membrana tympani, and that the tracings which it now gives bear favorable comparison with those first made.

The different methods for obtaining graphic and photographic illustration of sound-waves, are ably treated by C. J. Blake in the American Journal of Otology. In the same journal Prof. E. W. Blake gives a description of a machine for drawing compound harmonic curves; producing results corresponding to those obtained by photography or by magnifying the impressions on the tinfoil of the phonograph.

Prof. Tyndall delivered a course of lectures on "Sound," at the Royal Institution. See Review in American Journal of Otology, i.

Jaques has determined the velocity for very loud sounds

by automatic measurements at different distances. See Review in American Journal of Otology, i.

O. Wolf has made a series of experiments with Edison's phonograph, from which we extract the following points: The connection of the membrane to the sound receiver in the phonograph differs from our sound-conducting apparatus in the following respects: The membrane of the phonograph stands at right angles to the wall of the sound-receiver, while the membrana tympani forms an angle of 140° with the upper wall of the meatus. (In respect to this observation, we would call the attention to a similar comment made by Ackroyd in regard to the telephone, as stated in last year's Report, and also to a statement of Schwartze, that he has often seen a very "perpendicular" position of the drum-membrane in very musical people. This same position, resembling more that of the membrane in telephone and phonograph, has also been observed by Bonnafont, Lucae and von Tröltsch.) Wolf, in his article, further speaks of the material of which the membrane is made, and believes that, if it were possible to prepare a fine animal membrane, retaining the same curvature and tension as that of the membrana tympani, the vibrating power of the apparatus would be very much increased. He concludes that the excursions of the membrana tympani are much greater under the vibrations of R, and for this reason patients, who have lost a portion of their membrana tympani, hear in the experiments the R sounds with greater difficulty. After long continued speaking in the receiver, probably from relaxation of the membrane from dampness, the S sound vanished first. Without considering the possible value of this symptom to physiology and pathology of the conducting apparatus, he calls to mind the observation of Moos, that in sclerosis of the drum and its contents with secundary labyrinth affection, the higher tones, and particularly the hissing sounds, are the most difficult to hear and the first to suffer.

Berthold has written a communication on the optical rep-

resentation of the vibrations produced by the telephone, obtained by the aid of a movable gas-flame and a prismatic rotating mirror. See Report on Progress of Otology in Arch. of Otol., viii.

The desire to use the telephone and microphone for diagnostic purposes in general practice and for demonstration, which led to numerous fruitless experiments, mentioned in last year's Report, has been partly crowned with success by the invention of the "*Sphygmophon*," by Stein, in which the telephone is used to make the pulsation of the radial artery audible; and the "*Stethoscopic Microphone*" of Ducretet, although not yet available for the intended purpose, (being still too susceptible to outside disturbances), yet warrants a hope of a successful issue.

Among the recent literature on the ear, we wish to notice two treatises written in a popular form. One is by C. H. Burnett, on "Hearing, and how to keep it;" the first of a series of American Health Primers, issued at Philadelphia. Although popular works on medical subjects are often held in condemnation, we believe that a treatise of this kind is necessary. There exists so much ignorance in regard to the ear, leading to a belief in the most absurd external applications, that it gives a sense of pleasure when we come in contact with a patient whose knowledge of the ear is not confined to a visible auricle, or who does not insist upon either collection or absence of ear-wax as the source of his trouble. Hence we can only feel rejoiced at any efforts to enlighten all classes in this respect, and we believe that the author has admirably succeeded in condensing in the first fifty pages of his little book the intricate anatomy of the ear and the elementary physiology of hearing and sound. We believe, however, that for the classes it is intended for, references to journals like the Archives of Ophthalmology and Otology, etc., are unnecessary.

The second is by A. M. Mayer, on "Sound," one of the Experimental Science series, 1878. It contains an elemen-

tary treatise on sound, illustrated by experiments, many of them entirely new and original, written in a comprehensive form and style, for the use of teachers and beginners in experimental science.

The interesting reports on Progress of Otology, by J. O. Green, are still continued in the Boston Medical and Surgical Journal. This publication in a journal intended for the medical profession in general, brings to them some idea of the valuable work which is continually done in our special department.

The *American Journal of Otology* made its first appearance in January of this year. It is a quarterly journal of Physiological Acoustics and Aural Surgery. All the original articles are American contributions, and while those relating to surgery are highly interesting and instructive, a very prominent position is given to physiological acoustics. To quote the words of the editors in their introductory: "The work which is being done in the field of otology naturally suggests to the aural surgeon the necessity of overstepping what has usually been considered the boundary of his professional province, by turning his attention to investigations in physics as the groundwork of his physiological and pathological studies, in order that he may be the better qualified to make that practical application of the knowledge to be so acquired, in the conservative treatment of the various diseases of the ear."

It contains also an excellent review of the current literature on Anatomy, Physiology and Acoustics. This review, and also the extensive articles on the Progress of Otology by Steinbrügge, Wolf and Loewe, in the Archives of Otology, give in English language, a synopsis of otological literature which cannot be surpassed. In writing this report, only such articles have been treated more in detail which up to July 1, 1879, had not been reviewed in either of these journals, while others have been simply mentioned by title, and with reference to the journal in which the review is found.

Index to the Articles mentioned in Part I. of this Report, arranged in Alphabetical Order of their Authors' Names.

Berthold, E.—Optische Darstellung der Schwingungen, welche durch das Telephon erzeugt werden. "Monatsschr. f. Ohrenh.," 1878, No. 6; refer. in Arch. f. Ohrenh., XIV., p. 267, by Blau.

Bezold.—Ueber die Corrosions-Anatomie des Ohres mit Rucksicht auf die Ohrenheilkunde. "Ber. d. Münchener Naturf. Vers.," 1877, p. 310; refer. in "Centr. Blatt. f. med. Wissensch.," 1878, No. 26, by Loewe.

Blake, C. J.—The use of the membrana tympani as a phonautograph and logograph. "Arch. of Ophth. and Otol.," VII., p. 457.

Blake, C. J.—The graphic and photographic illustration of sound-waves. "Amer. Journ. of Otol.," I., p. 89.

Blake, E. W.—Machine for drawing compound harmonic curves. "Amer. Jour. of Otol.," I., p. 81.

Buck, A. H.—Complete occlusion of the external auditory canal by a dermoid membrane; an evidence of horizontal motion outward in the epidermis of the canal. "Transact. of the Amer. Otol. Society," 1878, p. 231.

Bürkner, K.—Zur Casuistik der Knochenlücken im Schläfenbeine. "Arch. f. Ohrenh.," XIV., p. 136.

Bürkner, K.—Bericht uber die in der Zeit vom 20 Februar bis 31 December, 1878, in meine Polikinik für Ohrenkranke beobachteten Krankheitsfälle. "Arch. f. Ohren.," XIV., p. 228.

Burnett, C. H.—Aspergillus in the living ear. "Amer. Journ. of Otol.," I., No. 102.

Burnett, C. H.—Hearing, and how to keep it. "American Health Primers," 1879.

Dennert, H.—Zur Physiologie der Tuba Eustachii auf Grund einer Beobachtung von doppelseitigem organischen Verschluss der Rachenmündung derselben. "Deutsche Zeitschr. f. prakt. Med.," 1878, No. 41; refer. in "Centr. Blatt d. med. Wissensch.," 1879, No. 7, by Schwabach.

Ducretet.—Stethoscopic microphone. Refer. in "Amer. Journ. of Otol.," I., p. 57.

Flesch, M.—Zur Kenntniss der sogenannten Dehiscenz des Tegmen Tympani. "Arch. f. Ohrenh.," XIV., p. 15.

Flesch, M.—Die Anwendung von Gemischen der Chromsäure und Osmiumsäure zur Untersuchung des Gehörorganes kleinster Thiere. Refer. in "Monatssch. f. Ohrenh., 1879, No. 4.

Galton.—A form of whistle for testing the hearing for high musical tones. "Physic. Soc. Proceed.," London: refer. in "Arch. of Ophth. and Otol.," VII., p. 114, by C. J. Blake.

Gellé—Period at which the fœtal condition of the middle ear disappears. "Gazette Med. de Paris," Août, 1878; refer. in "Amer. Journ. of Otol.," I., p. 77.

Götte, A.—Beiträge zur Entwickelungsgeschichte der Wirbeltière. § III. Ueber Entwickelung des Central-nerven Systems der Teleostier. "Arch. f. mikr. Anat.," XV., p. 139; refer. in "Centr. Blatt f. med. Wissensch.," 1879. No. 1, by Loewe.

Gradle, H.—Function of the semi-circular canals. "Chicago Med. Journal and Examiner." August; refer. in "Arch. of Ophthalm. and Otol.," VII., p. 510. by S. M. Burnett.

Green, J. O.—Recent Progress in Otology. "Boston Med. and Surg. Journ.," July 4, 1878, No. 1.

Green, J. O.—Recent Progress in Otology. "Boston Med. and Surg. Journ.," Jan. 9, 1879, No. 2.

Grüber, J.—Review of Politzer's "Lehrbuch," in "Monatssch. f. Ohrenh.," 1879.

Grüber, J.—Zur Entwickelungsgeschichte des Hörorganes der Säugetiere und des Menschen. "Monatss. f. Ohrenh.," 1878, No. 5; refer. in "Centr. Blatt f. med. Wiss.," 1878. No. 50, by Schwabach.

Hartmann, A.—Mittheilung über die Function der Tuba Eustachii. "Arch. f. Anat. u. Physiol. von His. Braune. Dubois-Reymond." 1877; refer in "Arch. f. Ohrenh.," XIV., p. 55. by Jacoby.

Hartmann, A.—Experimentelle Studien uber die Function der Eustachischen Rohre. Leipsig, 1879. Refer. in "Arch. f. Ohrenh., XIV., p. 241, by Bürkner.

Hartmann, A.—Ueber eine neue Methode der Hörprüfung mit Hilfe electrischer Ströme. "Monatss. f. Ohren.," XII., 7; refer. in "Arch. of Ophth. and Otol.," VII., p. 114, by Blake.

Hartmann, A.—On the formation of sequestra in the mastoid process of the child. "Arch. of Otol.," VIII., p. 26.

Hensen—Beobachtungen uber die Thätigkeit des Trommelfellspanners bei Hund und Katze. "Arch. f. Anat. u. Physiol. Physiologische Abtheilung," 1878, p. 312-320. Refer. in "Arch. f. Ohrenh.," XIV., p. 278, by Blau.

Jaenicke, J.—Beitrag zu den Anomalien der Schädelbasis. Inaug. Diss. Kiel. 1877.

Jaques, W. W.—Velocity of very loud sounds. "Amer. Journ. of Science and Arts," Febr., 1879; refer. in "Amer. Journ. of Otol.," I., p. 141.

Kirchner, W.—Ueber das Vorkommen der Fissura mastoidea-squamosa und deren praktische Bedeutung. "Arch. f. Ohrenh.," XIV., p. 190.

Kirk-Duncanson.—One Hundred Cases of Ear Diseases. "Edinb. Med. Journ.," March, 1878.

Krause, W.—Die Glandula tympanica des Menschen. "Centr. Bl. d. med. Wiss.," 1878, No. 41.

Kuhn.—Untersuchungen über das häutige Labyrinth der Knochenfische. "Arch. f. Mierosc. Anat.," XIV., p. 264; refer. in "Arch. f. Ohrenh.," XIV., p. 53, by Steudener.

Loewe, L.—Ueber Entstehung des knorpeligen und knochernen Labyrinths. "Centr. Blatt d. med. Wissensch," 1878, No. 30.

Loewe, L.—Report on Progress of Otology in "Arch. of Otol.," VIII., Embryology and Comparative Anatomy.

MacDonald, J. D.—On the anatomy of the organ of hearing in relation to the discovery of the principle of the Microphone and Magnophone. "Nature," July 11, 1878.

Mayer, A. M.—Proposed method of measuring the relative intensities of the sensations of sounds. "Amer. Journ. of Otol.," I., p. 87.

Mayer, A. M.—Sound. "Experimental Science Series," 1878.

Moos, S.—On the blood-vessels and the circulation in the membrana tympani and manubrium mallei. "Arch. of Ophthalm. and Otol." VI., p. 574.

Munk, H.—Ein Fall von einseitigem Fehlen aller Bogengänge bei einer Taube—Sep. Abdr. aus d. "Arch. f. Physiol.," 1878; refer. in "Arch. f. Ohrenh.," XIV., p. 277. by Blau.

Politzer, A.—Lehrbuch der Ohrenheilkunde. Leipsig, 1878. 1ter Theil.

Pritchard, U.—On the development of the organ of Corti, in "Proceedings of the British Med. Association, Brit. Med. Journ.," Sept. 7, 1878; ref. in "Amer. Journ. of Otol.," I., p. 59.

Rauber, A. u. Moldenhauer, W.—Ist die Tuben-Paukenhöhle Product des Vorderdarms oder der Mundbucht. "Arch. f. Ohrenh.," XIV., p. 36.

Rüdinger.—Ueber die topographisch-anatomischen Verhältnisse der Gewebs-elemente des Gaumensegels und des Kehlkopfs Ber. d. Münchener Naturf. Vers. 1877, p. 340; refer. in "Centr. Bl. f. med. Wissensch," 1878, No. 25. by Loewe.

Schwartze, H.—Pathological Anatomy of the Ear. Translated by J. O. Green.

Sexton, S.—The relations of the conducting mechanism of the ear to abnormal hearing. "Transactions of the Amer. Otolog. Society," 1878, p. 235.

Stein.—Das Sphygmophon, ein neuer electro-telephonischer Apparat zur Diagnose der Herz-und Pulsbewegungen. "Berl. Klin. Wochenschr." 1878, No. 49; refer. in "Centr. Blatt f. d. med. Wissensch," 1879, No. 19. by A. Fränkel.

Steinbrügge, H.—On the sinus tympani. "Arch. of Otol.," VIII. p. 53.

Steinbrügge, H.—Report on Progress of Otology in "Arch. of Otol.," VIII. Normal and pathological anatomy and histology.

Thompson, S. P.—Phenomena of binaural audition. "Philosoph. Magazine," Nov., 1878; refer. in "Amer. Journ. of Otol." I., p. 143.

Turnbull, L.—The limits of perception of musical tones by the human ear. "Boston Med. and Surg. Journ.," May 29, 1879, No. 22.

Tyndall, Prof.—Lectures on Sound. "London Times," Febr. 21, 1879; refer. in "Amer. Journ. of Otology," I., p. 149.

Urbantschitsch, V.—Ueber den Einfluss der Bewegungen des Kopfes auf die Schallempfindung. "Arch. f. Ohrenh.," XIV., p. 1.

Urbantschitsch, V.—Bemerkungen über die Bildung des Hammer-Ambos

Gelenkes. "Schenck's Mittheil." 1878, p. 230, refer. in "Arch. f. Ohrenh.," XIV., p. 292, by Bürkner.

Vulpian.—De la corde du tympan. "Acad. des Sciences," 29 Avril, 1878, refer. in "Arch. f. Ohrenh.," XIV., p. 147, by Kuhn.

Weber-Liel.—Der Aquæductus cochleæ beim Menschen. "Mon. f. Ohrenh.," 1879, No. 3.

Wodtke, A.—Ueber Hörprüfung mit besonderer Berücksichtigung der Methode mit Hilfe electrischer Ströme. "Inaug. Diss. Rostock." 1878, refer. in "Arch. of Otol.," VIII., p. 101, by O. Wolf.

Wolf, O.—Experiments with Edison's phonograph. "Arch. of Otol.," VIII., p. 58.

Wolf, O.—Report on Progress of Otology, in "Arch. of Otol.," VIII. Physiology.

Zuckerkandl, E.—Zur Anatomie des Warzenfortsatzes. "Mon. f. Ohrenh.," 1879, No. 4.

Zuckerkandl, E.—Vierter Beitrag zur Anatomie des Gehörorgans. "Mon. f. Ohrenh.," 1878, No. 7.

Zuckerkandl, E.—Ueber eine typische Spaltbildung an der hinteren Wand des äusseren Gehörganges. "Monatsschr. f. Ohrenh.," 1878, No. 4.

II.

PATHOLOGY AND THERAPEUTICS.

By David Webster, M. D., *of New York.*

1. Dr. Albert H. Buck, in a carefully written article published in the "Medical Record," lays it down as a rule, "*that chronic otorrhœa owes its existence to the presence of granulation tissue* (or polypi) *in the middle or outer ear, or to a circumscribed caries of some portion of the temporal bone.*" Dr. B. sometimes finds an exception to this rule in phthisical or tubercular patients, but in otherwise healthy individuals exceedingly rarely. If the physician expects to relieve his patient of his otorrhœa, it is essential that he should ascertain *where* the caries or the granulation tissue is located. It is here that the importance of thorough cleansing and careful inspection comes in. If the caries or granulation tissue is not found in the external canal, and a perforation of the drum-head exists, the pus or mucus that fills the middle ear must be mopped out by passing the cotton-holder, armed with absorbent cotton, through the perforation. "In this way one can often bring to light a polypoid growth which otherwise would escape observation. But in many cases, such a cleansing of the middle ear is not sufficient. The polypus may be so situated that no portion of it can be seen through the perforation. For instance, it may spring from the upper or outer wall, and may hang down on one side or the other of the opening. In addition, therefore, to the cleansing, it is advisable to bend the end of the probe slightly, and then, passing it in through the perforation, to rotate it in such a manner that it will be likely to bring into the field of vision any polypoid growth that may be located in the immediate vicinity." Dr. Buck removes large polypi, presenting within easy reach at the outer orifice of the canal, by means of an ordinary dressing forceps, or, better yet,

Hinton's polypus forceps. If the polypus is situated deeply in the canal, he prefers Blake's snare. In using the latter, the character of the wire employed is of great importance. Dr. B. uses very fine malleable steel wire, size No. 37. Wire of this size possesses all the strength required, and at the same time causes far less pain to the patient, on coming in contact with the walls of the canal.

Dr. B. thinks there is very little danger attendant upon the skilful use of the snare. He has only once encountered sufficient bleeding to require the use of a tampon. He once included the handle of the hammer, along with the peduncle of the polypus, in his wire loop, but discovered his error before any harm was done.

When the polypoid mass has been so far extirpated that it cannot be encircled with a wire, Dr. B. resorts to the use of caustics and astringents. Of caustics, he prefers nitric acid, and has devised an ingenious instrument which he calls a "porte-acid," for its application. "This instrument consists of a slender glass tube, through which a platinum wire of moderately small size passes. One end of the wire is bent upon itself, so as to prevent the mop of cotton wool, which is wound around it, from falling off. When the instrument is to be used, the wire should be first pushed into the tube far enough to carry the mop end of the wire well outside of the flaring end of the tube. The mop having been dipped into the acid, the other end of the wire is then to be pulled out far enough to draw the mop well back into the flaring mouth of the tube. The base of the growth having been thoroughly dried, the flaring end of the tube should be placed firmly upon the raw surface, and, while in this position, the mop should be pushed down firmly against the part to be cauterized. The reaction which follows is very slight, and the pain of but short duration. The best way to remove the mop from the platinum wire is to burn it off in the gas flame." Where the origin of the growth is in the tympanic cavity, the acid should be applied with great cau-

tion. In a few cases, the snare will be found to have done its work so effectually that cauterization may be omitted altogether. The last stage of the treatment consists in the application of astringents. Dr. B. first dries the parts with mops of absorbent cotton, and then lays upon the dried surface, pretty thickly, powdered burnt alum, or iodoform, or a mixture of the two. If we fail to arrest the otorrhœa, we may safely infer the existence of carious bone.

2. Dr. Holt relates the case of a gentleman who had had suppuration of the middle ear for thirty-nine years. He had become nervous, so that he could not attend to his business. Dr. H. found both membranes entirely destroyed, and in one ear was a growth as large as a pea. This was removed very carefully, and, if he ever saw anything, he then saw the dura mater. The man improved under treatment.

In inflating the middle ear, Dr. Holt employs a modification of Politzer's method, which does away with the swallowing of water by filling the mouth tensely with air, while the air bag is discharged as in Politzer's method. Dr. J. O. Tansley, one of the clinical assistants at the Manhattan Eye and Ear Hospital, has modified Dr. Holt's modification, and causes patients to pucker up their lips and blow from their mouths while he forces air into the nasal cavity with the air-bag. The middle ear can generally be inflated by either method. When the Eustachian tubes are so far obstructed by inflammation that air does not enter the middle ear upon the use of Politzer's method, Dr. C. R. Agnew syringes out the posterior nares with a warm solution of common salt, supercarbonate of soda, or sulphate of magnesia, (drachm 1 to water 1 pint). After allowing an interval of fifteen or twenty minutes to elapse, he then repeats the inflation with Politzer's inflator, and almost invariably with the result of causing the air to penetrate the drum cavities. Secretion from the posterior nares is always more or less freely induced by the warm saline wash, and thus the mouths of the Eustachian tubes cleansed. Moreover, swelling of the mu-

cous membranes is thus quickly lessened in many cases, and the calibre of the tubes increased. Applications of pure glycerine to the sides of the posterior nares in the vicinity of the Eustachian tubes, by inducing rapid and copious watery transudation, also act in a similar manner.

3. Dr. S. Sexton has devised some new aural instruments and a new aural pocket-case, of which he publishes cuts and a description. Dr. S. objects to the lance-shaped paracentesis knife, in common use, that it may, after perforating the drum-head, inflict a painful or injurious wound upon the posterior wall of the tympanum. He thinks this danger is avoided by using a chisel-shaped myringotome.

4. Dr. W. A. Hammond has seen cases where marked cerebral symptoms were developed, such as hallucinations, temptations to suicide, voices, &c., and, upon the removal of impacted cerumen from the ear, disappeared. He has found that the peculiar roaring produced by the introduction of the end of the finger into the ear, is due to the circulation of blood in the finger, the latter merely acting as a conductor of sound. That this is, in the main, correct, your writer has convinced himself by experiment.

5. Dr. J. C. Shaw made an autopsy in a case where death had resulted from brain disease, the result of chronic, suppurative inflammation of the middle ear, and where the mastoid had been trephined without relief. Dr. S. found a small, necrosed point in the dura mater, just above the roof of the tympanum, with a sinus leading up to an abscess. He has made post mortem examinations in five or six cases where death resulted from meningitis depending upon middle ear trouble, and in three cases he has been able to trace the pus along the Gasserian ganglion and to the fifth nerve.

6. Dr. Tansley enriches our otological nomenclature with the term "hydro-tympanum," which he applies to that condition where the tympanic cavity contains a watery fluid which is not the result of inflammatory action, but simply a

dropsical transudation. He reports a case, in full, corroborative of his views.

7. Dr. Strawbridge claims excellent results from the use of ether vapor, in cases of chronic catarrh of the middle ear. He drops eight or ten drops into a Politzer's bag, and then inflates as usual. When the writer was house surgeon in the Brooklyn Eye and Ear Hospital, in 1869–70, ether was used, in this way, in a large number of cases; but, it was believed, with little or no benefit. In many cases, however, where the patient was unable to feel pure air enter the ear, the ether vapor was felt distinctly; and that it had entered the tympanic cavity could nearly always, if not always, be demonstrated by the slight reddening of the drum-head which it produced. If ether has once been used in a Politzer's bag, the bag should never be used again without ether, for it so acts upon the rubber as to produce a very unpleasant smell.

8. Dr. Connor reports a case of acute inflammation of the middle ear, in which the membrana tympani was thrown off entire, and in which a new membrana tympani was reproduced, closely resembling that in the sound ear.

9. Dr. C. H. Burnett reports twenty cases of aspergillus in the ear. In regard to the etiology, he says: "The chief causes of the growth of this parasitic fungus in the ear, I find to be undue picking and scratching of the ear, and dropping in and leaving there oils and fats of various kinds, and pieces of vegetable matter. These becoming rancid, or putrescent, a fitting soil for the aspergillus is given." Dr. B. cautions us against conveying the parasite from one patient to another by means of syringes, specula, cotton-holders, &c.

The only two parasiticides he has ever employed are alcohol and hyposulphite of soda. The former he uses either pure or diluted, the latter in solution, three grains to the fluid ounce of water. After killing the fungus with the above applications, he removes it from the ear by means of the syringe and by dossils of cotton.

10. Dr. Buck reports twenty-one cases of syphilitic disease of the ear, with running comments upon the same. Dr. Buck says: "It is a peculiarity of poisoning by syphilis, that almost any spot in the body may become the seat of well-marked textural changes, such as increased vascularity, infiltration, proliferation, or death. The parts in the immediate neighborhood may exhibit no evidences whatever of participation in the process. Thus, for example, the mucous membrane lining the niche for the round window, or the membrana tympani secundaria itself, may become congested and very much swollen, without narrowing of the Eustachian tube, without the exudation of fluid into the middle ear, and without the slightest change in the condition of the drum-membrane; or, in other words, without any discoverable evidence of disease in the middle ear. The swelling of these parts, and especially of the secondary tympanic membrane, cannot take place without producing pressure upon the fluid of the labyrinth. This lesion, therefore, would be competent to produce hardness of hearing, staggering gait, and dizziness. The swelling might increase to such a degree that the displacement outward of the footplate of the stirrup would no longer compensate for the pressure exerted at the round window upon the contents of the labyrinth. In that event, we should have not only a mechanical interference with the working of the cochlear apparatus, but also an intralabyrinthine anæmia, due to pressure, which would very soon cause disturbances in the nutrition of the delicate structure of the cochlea."

11 and 12. Dr. Buck reports one case, and Dr. Weir two cases, of intratympanic vascular tumor, with a pulsating intact drum-head.

Dr. Buck's case was seen only twice, at an interval of two years, and no treatment was resorted to.

Dr. Weir's first case was cured by repeated punctures and applications of liquor ferri persulph., nitric acid, and acid nitrate of mercury. His second case was much benefitted by

punctures and applications of chromic acid, but died of phthisis before a cure was effected.

13. Dr. J. O. Green reports an interesting case of otitis intermittens, in which a suppurative inflammation attacked either ear alternately, and was always accompanied by malarial symptoms. The cause was believed to be blood poisoning from sewer-gas or defective drainage, and it was not until the patient was removed from the infected premises that she recovered.

14. Dr. Sexton has found that the first decimal trituration of the sulphide of calcium taken internally in one grain doses every two or three hours exercises a marked control over furuncular and diffuse inflammations of the external auditory canal. "Furuncles in the meatus," he says, "under the use of this medicine are frequently observed to abort and dry up without a discharge of pus."

15. Dr. Knapp states that 6.53 per cent. of his ear patients have had primary acute purulent inflammation of the middle ear. He has collected 27,350 cases of ear disease treated in America, and finds that 6.08 per cent. belong to this class. The percentage in Europe is somewhat larger, 6.27.

The Dr. reports 182 cases. At least 80 per cent. were cured; 4.39 per cent. terminated in chronic otorrhœa. Four cases, 2.19 per cent. terminated fatally, three with cerebral symptoms, the fourth with diphtheria. Dr. K. has seldom resorted to *paracentesis* of the membrana tympani. He has not opened the mastoid cells in any of his cases, but has frequently made an incision down to the mastoid with good results. He lays great stress upon rest in the treatment of these cases, and keeps his patient in bed.

16. Dr. Gruening reports two cases of acute otitis media with mastoid complications, in which he trephined the mastoid with immediate relief and rapid recovery of the patient. In both cases there had been no cessation of the flow of pus from the external auditory canal. The symptoms

were high fever, redness, swelling and tenderness of the mastoid, which was the seat of violent pain radiating towards the temple and occiput.

17. Politzer calls special attention (p. 92) to adhesions and ultimate anchylosis of the articulations of the ossicles. These usually occur in the course of an inflammation, but occasionally without a trace of a diseased process in the mucous lining of the middle ear.

P. says that the statements, made by prejudiced persons, that ruptures of the drum-head have frequently been observed after inflation of the middle ear by his method, are disproved by the following facts: 1. Ruptures of the drum-membrane have been observed not only after inflation by Politzer's method, but also after Valsalva's experiment, and after catheterization of the Eustachian tube. 2. That ruptures of the drum-membrane are very rare is evident from the fact that only 14 cases have been reported in 13 years. 3. That ruptures of the drum-head are not attended by injurious results is evident from the fact that in almost all the published cases improvement of hearing followed the rupture.

These ruptures were most frequently observed in atrophic and calcific membranes, and in those thinned by cicatricial tissue.

18. Von Tröltsch maintains that of the 38,489 deaf mutes in Germany, less than one-half are congenital, and that in one-fifth of the cases early and energetic treatment of the aural affection would have prevented the occurrence of that condition.

19. Moos has frequently, at autopsies, found concretions of phosphate of lime in the internal auditory canals of ear patients. He has come upon them not only in the periosteum, but in the neurilemma of the acoustic nerve, and in the membranous saccules of both vestibules.

Moos reports an interesting case of "deafness of both ears, developing with rapidity and associated with severe

and continuous subjective symptoms; hyperæsthesia of the scalp, with neuralgic pains of the head, sleeplessness, melancholia, and suicide by drowning." An autopsy showed "pachymeningitis, hyperæmia and hemorrhage in the osseous substance of both petrous bones, hyperæmia of the mucous membranes of both tympanic cavities, hemorrhagic infiltration of the neurilemma of both, and of the nerve substance of the left auditory nerve, sclerosis of the articular covering of the ossicula, and phosphate of lime concretions in the trunks of both auditory nerves and in the lamina spiralis membranacea of the left cochlea."

20. Hartmann reports the case of a man who had suffered from phthisis and otorrhœa for years. On autopsy, H. found extensive destructive processes in both drums. In addition to these common pathological changes, the basal half of the anterior crus of the left stapes was wanting, and the posterior crus and head were so softened that they could be bent in any direction. The right stapes was normal in form, but softened so that its head could be bent at a right angle. The bases of both these bones were attached with the normal amount of firmness in the fenestra ovalis. The microscope showed the normal bone corpuscles in the course of both stapes. Similar softening was found in the squamous portion of both temporal bones. Hence, H. concludes that the marasmus accompanying the phthisical process was the cause of the softening of the bones.

21. Trautmann describes three interesting cases of traumatic disease of the ear. The first case is one of hemorrhages into the drum-membrane from a paroxysm of coughing. The patient, a man aged 21, went to bed feeling well, having never suffered from ear or lung disease. He was awakened in the night by a fit of coughing, and suddenly became so deaf in his right ear that he could not hear his watch, applied *ad conchum*. He also had headache, a continuous humming in his right ear, and slight transient earache. Upon examination there were found, in the anterior

segment of the membrana tympani, four hemorrhages the size of a pin's head, and in the supero-posterior quadrant, a sickle-shaped hemorrhage, 3 mm. long, 1 mm. broad. The hemorrhages were evidently immediately beneath the layer of epidermis. It seems difficult to understand how a few extravasations beneath the dermic layer of the drum-head could reduce the hearing to such a degree. The case is analogous to those so frequently seen of subconjunctival ecchymosis from coughing and sneezing.

The second case is one of double rupture of the drum-head from a box on the ear.

The third case relates to a healed fracture of the pyramid of the petrous bone, the upper wall of the osseous portion of the auditory canal, and the drum-head of the left side, from a blow of the pole of a gun-carriage. In this case there was discharge of the *liquor cerebro-spinalis* from the external auditory canal. The patient recovered.

22. Grüber has heretofore taught that opacities of the membrana tympani are sometimes caused by adhesions of the surfaces of a fold of the membrane. He describes a special form of these folds which occurs in the supero-posterior margin of the membrane, close to the wall of the canal. When this fold projects into the meatus, with its free edge, a yellowish color is given quite distinct from the rest of the membrane; when, however, its free edge projects into the tympanum, a corresponding depression is visible externally. Such folds, G. believes, occur frequently, and when the free edge projects into the meatus, allowing the mucous surfaces to lie in contact, adhesions are formed between these surfaces, and the result is an opacity. The influence of such an opacity on the hearing is very variable. Sometimes, by the adhesion of the surfaces of the original fold the tension of the drum-membrane is brought more nearly to the normal, and the hearing improved. In the majority of cases, however, it produces a hypertension of the membrane, and impairs the hearing. Grüber recom-

mends, in the treatment of those cases, first a trial of inflation, and if this fails, a resort to multiple puncture of the opacity.

23. Moos gives the history of a male servant, aged 37, who had been treated with mercurials for secondary syphilis some seven years previously. In May, 1874, he was attacked, for the first time, with intense subjective noises. At the same time, paroxysms of vertigo and severe headache developed. The hearing was still normal. Notwithstanding the use of small doses of iodide of potassium, these symptoms abated, but were succeeded by intense pain in one tibia (periostitis). After a course of treatment at Marburg, towards the end of August a very great increase of the pains and subjective noises set in. The patient was admitted to the citizen's hospital at Frankfort, where he died October 15th. From Oct. 6th a fever temperature was recorded. Autopsy: Oedema of lungs; brain and its membranes very hyperæmic; spleen greatly enlarged; blood of a marked cherry-red color. Right petrous bone: (alcohol preparation) osseous substance sclerosed throughout; anchylosis of the stapes; periostium of the vestibule slightly thickened; connective tissue between the osseous walls of the vestibule and its membranous structure hyperplastic, and infiltrated with small cells. The exudation consisted of small, round, and oval, nucleated cells, uniformly and densely placed together. In regard to the diffusion of the infiltration, it was remarked that the periostium of the lamina spiralis ossea, and the zona pectinata, were much less infiltrated than the region of the teeth and the organ of Corti.

24. Schwabach reports a case of otitis media suppurativa with implication of the mastoid process, in which pressure upon the ear was followed by vertigo and nystagmus. There was no change in the pupils. The author offers an explanation of the spasmodic movements of the ocular muscles, based upon Cyon's experiments on animals, by assuming

that there was an irritation of the semicircular canals in consequence of the pressure exerted upon the ear. The manner in which this irritation is propagated to the cerebromotor centres of the respective ocular muscles is unknown. Judging from the history of the case, there must have been caries of the temporal bone.

25. No mastoid cells exist at birth, but there is an air cavity into which they develop later, and which exhibits the shape of a triangular pyramid, one of whose surfaces, directed upward, is formed by the continuation of the roof of the tympanum. This cavity, called by Wildermuth the antrum petrosum, increases in size, not alone through the growth of all the bony parts enclosing the cavity, but also through resorption of the inner surfaces of its walls, which occurs in a downward and backward direction. The first trace of the formation of the mastoid cells is found in the new-born; small ridges rise above the surface at the supero-posterior angle of the antrum petrosum, and at the anterior and outer surface which belongs to the squamous portion, and which, at this latter part, show a fan-shaped arrangement. These ridges develop especially from the outer portion of the antrum petrosum, which belongs to the squamous bone, and, encroaching upon the cavity, finally unite in a fan-shaped arrangement, with the opposite wall of the antrum which belongs to the squamous bone, and divides the space into cells. This bony framework is further subdivided by other ridges being developed from them, which, by the development of partition cells, originate the mastoid cells. With the development of the cells there is a simultaneous enlargement of the cavity, especially toward the mastoid process, which develops from the time of birth, by a conversion of the cancellous bone into air-cells. Of special importance, Hartmann considers the sutures which unite the squamous and petrous portions of the bone. This suture runs through the middle of the roof of the original antrum petrosum, and extends backwards and outwards to the incisura parietalis;

from that it closes as the mastoideo-squamous suture upon the outer surface of the mastoid process; runs from in front downward to the posterior wall of the auditory meatus, and from here returns upward again to the tympanum. The mastoideo-squamous suture is found ossified at a very early period. The petro-squamous suture, on the other hand, always shows traces of its existence on the floor of the middle cranial fossa, and is even to be recognized at advanced periods of life. The inflammatory process spreads from the tympanum and antrum petrosum to the neighboring regions, much more easily before the ossification of the petro-squamous suture than at later periods of life. There are cases in which meningeal symptoms arise in a new-born child, a few days after the appearance of an otorrhœa, and end fatally. The older the child the less likely is the consecutive cerebral affection to occur. Toynbee rightly directs attention to the fact that up to the second or third year of life, the cerebrum is most frequently affected, corresponding to the anatomical relations, while affections of the cerebellum and of the transverse sinus appear only at a later age.

Collections of pus in the antrum produce destruction of the external surface by necrosis, and exit to the outer surface much more frequently than to the interior of the skull, forming an abscess under the skin. When the formation of an abscess behind the ear occurs in the course of a purulent inflammation of the tympanum, the pus usually finds its way through the squamous portion, which is much nearer and more favorable to its passage than the mastoideo-squamous suture, as held by Bezold.

Hartmann believes that, in children, the inner portion of the mastoid cells has a greater influence than the sutures upon the development and extension of the diseases of the bones, since during the formation of the cells this part is in free communication with the tympanum, while in adults the cells communicate only through small openings.

In forming our prognosis, the constitution of the patient

should be taken into account. Unfortunately, we have mostly to do with sickly children of scrofulous constitutions, so that the prospect for a cure is unfavorable. Small sequestra are discharged through the meatus, or through an external fistulous opening; larger sequestra must be removed by an operation. If the sequestrum remain in the antrum, the patient is in danger of losing his life by scrofula or tuberculosis, by extension of the inflammation to the brain and to the large blood-vessels, by resorption of inflammatory products, by pyæmia and septicæmia.

The opinion of Bezold that operative removal of the sequestrum before it has advanced toward the meatus is only indicated when threatening symptoms intimate that the upper or inner wall of the antrum and the membranes of the brain are beginning to be affected, perhaps, also, with a facial paralysis of long duration, if the sequestrum is already movable, is not shared by Hartmann, inasmuch as we cannot arrest the process at the approach of threatening symptoms. When tuberculosis, meningitis, abscess of the brain, or pyæmia are present we will scarcely succeed, by the operation, in preventing a fatal issue.

It is of the greatest importance to prevent these complications, and this can only be done by operative interference. If we do not operate, the complications must ensue and lead to death; by the operation, we effect a cure under favorable circumstances, under unfavorable circumstances we have at least made the attempt to avert the fatal result, which surely would have followed had we not operated.

Hartmann opens the mastoid, not only when his diagnosis of a sequestrum is absolutely sure, but also when it seems probable; since, if no sequestrum be found, the patient will at least have been helped by the removal of the granulations and caseous patches present. Hartmann advises not to operate too early. The looser the sequestrum and the more the granulations have developed between the sequestrum and the walls of the antrum, the more favorable the prognosis.

Hartmann directs particular attention to the fact that in childhood the anatomical relations, as regards opening into the lateral sinus, are more favorable than in adults, since the sinus is curved forward less sharply.

Hartmann's method of operating is as follows: An incision is made at the insertion of the auricle, and in such a way that the middle of the incision shall lie just below the level of the opening of the external auditory canal. If a fistula be present, the incision should either pass through it or be united with it by a diagonal incision. In making the incision through the soft parts, care should be taken not to direct the point of the knife forwards; the surface of the mastoid process presses over into the posterior wall of the auditory canal without any sharply defined boundaries, and by pressing forward we incur the risk of loosening the posterior wall of the tympanum. The incision should be from 2 cm. to 3 cm. long. The sharp spoon is used in the removal of the granulations and bone that has become softened by caries.

In the after treatment, the wound is kept open by a thick drainage tube, so that subsequently, the sequestra gradually loosening themselves, may be detached with a probe and removed. The important duty in the after treatment is the regular removal of the accumulated secretions by syringing, at first with antiseptic, later with neutral, and lastly with astringent fluids.

26. Trautmann gives an account of 13 dissections of the ear in cases of thrombosis. He divides the embolic processes connected with the ear into two groups. In the first, the ear is the starting point of the embolic process; in the second, the embolic material is driven from some other part of the body into the ear. Of the first group, cases are sufficiently abundant; of the second, but few cases have, as yet, been recorded.

In all of Trautmann's cases, vegetations of some kind were found either in the heart or aorta. Of the 13 dissections, 4

showed emboli in the tissues of the middle ear; in the remaining 9 the ears were free; in 7 of the cases emboli were found in the fundus of the eye, in 2 the fundus was free; in 4 the eyes were not examined. In all of the 13 cases, the inner ear, the basilar and auditory arteries were free; in 2 cases the arteria fossæ Sylvii contained emboli. In the occlusion of the arteria fossæ Sylvii (continuation of the internal carotid) we have a proof that the direction of the vessels plays a very important role in the embolic process. The emboli of the second group can, of course, occur in the inner as well as the middle ear. But they will be found most frequently where the direction of the vessels is most convenient for the entrance of the thromboti naterial. Before the thrombotic material reaches the labyrinth through the tortuous arteria vestibularis to the basilar artery and internal auditory artery, it will frequently be detained and arrested in other vessels. The entrance of the thrombotic material to the middle ear would be much more conveniently accomplished through the stylo-mastoid artery. The tympanic branch of the stylo-mastoid artery supplies the mastoid cells, the posterior part of the tympanic mucous membrane, and the mucous layer of the membrana tympani, and as it was in these parts that the emboli were found, it is evident that they had entered through the stylo-mastoid artery.

The most common cause of embolus in the ear was found to be recent endo-carditis, either primary or the result of a previous inflammation. The latter is very frequently the case. The ultimate result of the inflammation was thickening, sclerosis, retraction, and deformity of the valves. Relapses very often develop in the puerperal state, either during gestation or after birth; and there is an explanation here for the sudden deafness, as well as for the disturbance of sight to a high degree, occurring during the puerperal condition.

According to Virchow, recent endo-carditis has its seat most commonly in the mitral valves, then those of the aorta,

and, lastly, in the tricuspid, or pulmonary valves. In Trautmann's dissections, it existed in the aorta in 5 cases, in the mitral valves in 3, in both the aorta and mitral valves in 3, in both the mitral and tricuspid valves in 1, and in the mitral and tricuspid valves and the aorta in 1 case. At the seat of the endo-carditis, small, wart-like deposits were found, consisting microscopically of fibrin and micrococci. The latter give the deposits a yellowish, or opaque look, and their specific and dangerous character. The micrococci are driven into the finest capillaries, occlude them, and occasion necrosis and hemorrhage. That degenerated thrombi in other parts of the body may also reach the ear, explains the cases of sudden deafness, e. g. after suppurative inflammation of the knee joint; it is also not improbable that after complicated injuries of bones, in which the marrow has been compressed and lacerated, fat emboli may reach the ear.

The anatomical changes found in 6 of Trautmann's cases were as follows: Macroscopically hemorrhagic dots in the drum-membrane, quite numerous about the handle; less common at the periphery of the membrane, and on the mucous covering of the long process, and body of the ambos (?); and in the mucous layer of the pouches of the drum-membrane. The same hemorrhages were found in the muco-periosteal lining of the tympanum, the posterior part of the promontory, and on the floor of the tympanum. They were rare in the membrane of the fenestra rotunda and osseous part of the Eustachian tube. They were found also in the mastoid cells, in the lining of the mastoid cells, and in the folds of mucous membrane extending across the cells. These hemorrhagic spots were commonly of the size of a pin's head; in most cases round, but often oblong, and serrated. The edges of the hemorrhages were always sharply defined.

Similar hemorrhages were found in the tonsils, the tubal prominences, the vomer, the septum nasi, and in the ethmoid cells. In the 4 cases in which these hemorrhagic spots were

seen, there was a coagulum of fibrin in the tympanic cavity, or mastoid cells.

Microscopically examined, on its surface the tympanic mucous membrane showed numerous emboli in the arteries, and which occluded the mouths of the branches. The district of occluded vessels did not always lie in close proximity to the hemorrhagic spots. An embolus cannot be plainly seen in these localities. The emboli appear as finely granular masses. Cross sections showed the blood to be effused into the sub-epithelial and deeper layers of the connective tissue, and micrococci could be distinctly demonstrated in it.

In the membrana tympani the blood effusions were chiefly in the mucous layer, very little being found in the circular and radiary layers of the membrana propria. Micrococci could be seen in the effused blood, but not with certainty in the vessels. Trautmann believes that the hemorrhages are the result of necrosis produced by the micrococci, and also by congestion. The coagulum of fibrin is caused by a hemorrhage from the delicate vessels of the mastoid cells, which, on account of their delicacy, are not able to take up the escaped blood, but allow it to flow into the middle ear.

In the differential diagnosis, Trautmann calls attention to the occurrence of hemorrhages and fibrinous coagula in the middle ear in other diseases; 1. in parenchymatous nephritis; 2. in diphtheria.

These cases show that the functional disturbance in embolic diseases of the ear is not due to the hemorrhagic spots, but rather to the coagula of fibrin in the tympanum. Should the coagulum envelop the stapes, its function will be as much interfered with as if it were anchylosed. The hemorrhages in the drum-head can be seen during life.

Trautmann advises the examination of the ear in all cases of endo-carditis, even when no functional disturbance is present.

These embolic hemorrhages are always associated with

fatal embolic diseases of other organs, so that their occurrence in the middle ear must make the prognosis equally discouraging with the occurrence of hemorrhages in the eye.

I wish to acknowledge, with thanks, the assistance of Dr. J. A. Andrews, in writing this report.

INDEX OF ARTICLES.

1. *Buck, Albert H.*—Practical remarks on the removal of polypoid growths from the ear. The "Medical Record," New York, No. 403, 1878.
2. *Holt, E. E.*—Otitis Media Suppurativa. A paper read before the Maine Medical Association, July 11, 1878.
3. *Sexton, S.*—Some new aural instruments. "Medical Record," New York, No. 420, 1878.
4. *Hammond, W. A.*—Cerebral symptoms from impacted cerumen in the ear. "Medical Record," New York, No. 420, 1878.
5. *Shaw, J. C.*—Abscess of the brain. Loc. cit.
6. *Tansley, J. O.*—Hydro-tympanum. "Hospital Gazette," New York, No. 43, 1878.
7. *Strawbridge, G.*—Clinical lecture on the treatment of chronic disease of the nasal passages, Eustachian tubes, and middle ear. "Hospital Gazette," No. 41, 1878.
8. *Connor, L.*—Destruction and reproduction of the entire membrana tympani. "American Journal of Med. Sciences," January, 1878.
9. *Burnett, C. H.*—Twenty cases of the growth of aspergillus in the living human ear. "American Journal of Otology," January and April, 1879.
10. *Buck, A. H.*—Syphilitic affections of the ear. "American Journal of Otology," Jan., 1879.
11. *Buck, A. H.*—A case of intratympanic vascular growth, with membrana tympani intact. "American Journal of Otology," April, 1879.
12. *Weir, R. F.*—Two cases of intratympanic vascular tumor, with a pulsating intact drum-membrane. "Am. Jour. of Otol." April, 1879.
13. *Green, J. Orne.*—Otitis intermittens. "Am. Journal of Otology," April, 1879.
14. *Sexton, S.*—The use of calcium sulphide in the treatment of inflammation of the external auditory meatus. "Am. Jour. Otol.," Jan., 1879.
15. *Knapp, H.*—Primary acute purulent inflammation of the middle ear. "Archives of Otology," Vol. VIII., No. 1.
16. *Gruening, E.*—On the indications of opening the mastoid process in cases of otitis media purulenta acuta with implication of the mastoid cells. "Archives of Otol.," Vol. VIII., No. 1.

17. *Politzer, A.*—Lehrbuch der Ohrenheilkunde, Vol. I., 372 pages. 106 wood cuts.
18. *Von Tröltsch.*—A petition to the German government, &c. "Arch. für Ohrenheilkunde." Bd. XIV., Heft 2, p. 151.
19. *Moos, S.*—Phosphate of lime concretions in the trunk of the auditory nerve, &c. "Archiv. f. Psychiatrie." Band IX., Heft 1., p. 122.
20. *Hartmann.*—Softening of the ossicles. "Archiv. f. Ohrenheilkunde." Bd. XIII., H. 4, s. 259.
21. *Trautmann, F.*—Archv. f. Ohrenheilkunde, Bd. XIV., H. 2, Dec., 1878.
22. *Grüber.*—A peculiar peripheral opacity of the membrana tympani, &c. "Monatsschrift f. Ohrenheilkunde." Sept., 1878.
23. *Moos.*—Pathol. conditions of the labyrinth in constitutional syphilis, &c. "Virch. Archiv., Bd. 69, H. 2.
24. *Schwabach.*—Nystagmus in consequence of ear affection. "Deutsches Zeitschrift." &c., 1878. No. 11.
25. *Hartmann, A.*—Sequestra in the mastoid process of the child. "Archiv f. Augen u. Ohrenheilkunde." Vol. VII.
26. *Trautmann, F.*—Embolic diseases of the ear. "Arch. f. Ohrenh.," Bd. XIV., H. 2, s. 73.

CASE OF MENIÈRE'S DISEASE FOLLOWING PAROTITIS.

By Henry D. Noyes, M. D., *of New York.*

Dr. A. J. B., aged 38, living in Herkimer county, New York, came to me in April, 1878, with the following history: Just one month previous he had acute inflammation of both parotid glands; there was not much pain with it, either in the ears or in the glands. About the 7th or 8th day his pulse fell to 50 per minute, and he became dizzy on attempting to sit up in bed, but there was no headache. The stomach became very troublesome; he had constant nausea, and would vomit if he made any movement. He could hardly retain any food, and thought himself "bilious." His mind was not only entirely clear, but too active. About the same time, but a little later, he began to have tinnitus in the right ear, and with it loss of hearing, which after 2 or 3 days became total. On the 12th day of the disease, the right testicle became inflamed, and this must have been coincident with the ear and head symptoms. The orchitis subsided in a week. Patient was sick for about three weeks, and during the last two weeks had constant giddiness. He lost 18 pounds in weight. For much of the time he could not sleep, and took both morphia and bromides. When he went out doors he found himself giddy, and sometimes had difficulty in walking.

He came to see me on account of the loss of hearing in the right ear. On examination, it was found that he was totally deaf to all sounds in the right ear, and could not perceive the tuning-fork when placed on the teeth or on the forehead. The membrana tympani had a slight injection at its upper part, but was nearly normal. There was no tenderness upon pressure over the mastoid.

The most interesting features of the case were obtained by testing the patient's control over his equilibrium. When asked to walk across the room with closed eyes, he invari-

ably swerved to the left and almost fell. With feet close together, he could not stand erect with closed eyes, but tottered and would have fallen. These experiments caused the patient much surprise, and when they were afterwards repeated in the presence of the New York Ophthalmological Society, the same phenomena were exhibited in opposition to the strong efforts of the patient to control himself.

It would appear that a metastatic inflammation was set up in the labyrinth of the right ear, at the same time that a similar process took place in the testicle. We know how common is the latter affection, but the occurrence in the ear is certainly rare.

CONTRIBUTION TO THE PATHOLOGY OF THE TEMPORAL BONE.

By Thomas R. Pooley. M. D., *of New York.*

Case I. *Fracture of the Petrous portion of the Temporal Bone.*

The history of the case from which the specimen to be described was obtained is furnished, as follows, by my brother, Dr. J. H. Pooley, of Columbus, Ohio: "On the evening of Oct. 29, 1878, I was called in consultation to see Mr. Lindsey, aged about 30, a teacher in the Blind Asylum, himself partially blind, who a few hours before had been thrown from a wagon upon a hard asphalt pavement. He was able to get up and walk a short distance, after the accident, only complaining of feeling slightly shocked and confused. He was conveyed to the asylum, and soon afterwards became soporose and partially unconscious. This condition gradually increased until coma became complete. When I saw him, he was lying on his back in a condition of perfect unconsciousness and collapse. His pulse was slow,

40 in the minute and labored; breathing slow and irregular, not stertorous, but at intervals, and for a minute or two at a time puffing, almost whistling; pupils neither contracted nor dilated, but insensible to light. All attempts to rouse him to the least exhibition of consciousness were in vain. There was complete relaxation of the whole body, so that the presence or absence of paralysis on either side could not be determined. He had had before I saw him some convulsive movements on the right side.

From his right ear there was a free and continuous flow of bloody serum. After gently syringing out the ear with warm water, I was able with the speculum and mirror to observe a rupture of the anterior inferior portion of the membrana tympani. I made the diagnosis of fracture of the base of the skull, with extensive hemorrhage. It was proposed to administer croton oil, but to this I objected that it was incapable of doing any good, and any perturbation would be likely to increase the hemorrhage. As he was capable of swallowing, though slowly and imperfectly, very small doses of brandy and water were directed. A catheter was introduced into the bladder, but very little urine was found. He died before morning."

The post-mortem was made 24 hours after death by Dr. O. Frankenberg, Prof. of Pathological Anatomy in Starling Medical College, assisted by my brother and myself. There was slight extravasation of blood under the scalp; immediately under the right temporal bone there was a fresh clot as large as the spread hand of considerable thickness, and producing a marked depression of the cerebral substance. Upon removing the brain, a fissure fracture was found extending from the vertex directly through the temporal bone and across the base of the skull as far as the foramen magnum. This fracture was joined just above the mastoid process by another and shorter one only two inches in length, running upwards and backwards. The fractured portions were very slightly movable upon one another.

The temporal bone, which was carefully removed by Lucae's method, was given to me for dissection. It was put in Müller's fluid, and examined by Dr. Spitzka and myself several months later. The fracture is a fissure. A single fissure starts about $\frac{1}{2}''$ behind the groove for the middle meningeal artery, runs towards the latter, and there divides into two. The posterior one of these fissures runs through the pyramid of the temporal bone on its anterior superior face and nearly parallel with the petrosal crest. This fissure is a serrated one. The other fissure is but a continuation of the main one. A sector comprising the posterior inferior portion of the membrana tympani remains attached to the posterior fragment. The other and greater portion with the intact malleus to the anterior fragment, in which the greater part of the Eustachian tube is contained. The chorda tympani nerve has been torn through, a portion about $\frac{1}{3}''$ long protrudes from the posterior fragment. The articulation of the malleus with the incus is cleanly separated, otherwise the chain of ossicles are in their normal position and connections. Stapes is freely but excessively movable. The tear runs along the axis of the auditory canal, in its deeper parts, both on its upper and lower walls. In the anterior aspect of the deeper part of the canal, the soft tissues are separated from the bony walls. The lower scala of the cochlea was laid open and found to contain no blood. The superior semicircular canal being opened, a clear fluid issued therefrom, but it contained no blood. Furthermore, the other semicircular canals were opened into by a section transverse to the axis of the bone, and all found to be filled with a perilymph, but contained no blood. Bristles were passed from the canals into the vestibule.

The special interest which attaches to the specimen, it seems to me, is the immunity from injury of the structures of the inner ear, which, as is clearly shown, were not involved in the line of fracture. Of course the injuries which are found upon examination of the fractures of this bone

are naturally very variable. In this instance the damage, so far as the structures of the ear were concerned, were mainly expended upon the middle ear. Especially interesting was the complete disarticulation of the malleo-incudal joint, and the injury done to the chorda tympani. As we all know, the usual result of fracture of the petrous portion is death, either immediately from hemorrhage or compression, or later from inflammation of the brain or its meninges. That recovery may occur we also know; although union of the fracture seldom occurs by osseous consolidation, but more frequently by fibrous union.

If the case should not terminate fatally, total deafness is the rule, and this has usually been in such instances attributed to the destruction of the inner ear. It is questionable whether in such a case as the one now described (if recovery had ensued) there would be total deafness. Of course the amount of violence done to the auditory canal and tympanic cavity would have resulted in a more or less protracted purulent inflammation of the middle ear, which would have seriously compromised hearing; but with the nervous apparatus still intact, we cannot conceive that the deafness would have been absolute.

I regret that the opposite side was not examined, to see whether the fissure extended through to the other temporal bone. For such a case is recorded by Voltolini, (M. f. O., 1869, s. 110,) to which Schwartze refers in his book.

Case II. *Chronic Otitis Media. Necrosis of Inner Ear, Abscess of the Cerebellum.*

September 22, '78, I was consulted by Miss L., 23 years of age, on account of an offensive otorrhœa. She had suffered from earache and otorrhœa since childhood. The discharge would cease for a time, then after severe pain recur. The last attack of this kind, which she says began about four

weeks ago, was accompanied by distinct cerebral symptoms, nausea, vomiting and vertigo. S. P. Face pale and very much emaciated, with a chronic cough, and physical evidences of phthisis pulmonalis. Her mother died of phthisis. She complained of constant pain in the ear and vertex. There was a slight but most offensive otorrhœa, which suggested by its smell the presence of diseased bone. She complained of a very distressing vertigo which was always aggravated when assuming a recumbent posture. There was facial paralysis on the same side as the diseased ear. Examination of the ear after cleansing, showed a large linear-shaped perforation of the anterior inferior quadrant of the membrana tympani. The mucous membrane of the promotory, which was fully exposed, pale, an dthere were several spots of hemorrhage upon it, as well as upon the remnant of membrane. There was no evidence of any inflammatory action in the appearance of the middle ear, nor was the mastoid region either painful or swollen. h=o. v. $\frac{5}{60}$.

I ventured the diagnosis of extension of the ear disease to the brain, abscess of the cerebellum, and made an unfavorable prognosis. The propriety of trephining the mastoid was considered, but the operation rejected as not likely to do any good, as the extension was evidently not by this way. All the symptoms became rapidly worse. The pain was intense, the vertigo such that the patient thought the bed was going round, and although she was excessively weak, she assumed an upright posture most of the time for the relief to this symptom thus afforded. She retained her consciousness until only a few hours before her death. Vomiting was throughout a very distressing symptom. Death took place on the 29th inst., just one week after I first saw her. Treatment was merely palliative. Steaming the ear gave her more relief than anything else.

The post-mortem was made 24 hours after death, by Dr. Spitzka and myself, in the presence of Drs. Knapp, Chamberlain, Wright and Partridge.

Upon removing the calvarium, an abscess about the size of an English walnut, with a well formed pyogenic membrane, was found in the left hemisphere of the cerebellum. When opened, it gave issue to the most offensive pus. No abnormality of any other parts of the brain was found. The abscess itself was distinctly circumscribed, and there was no softening of the brain substance in its vicinity.

The temporal bone was removed for dissection. No evidence of necrosis of the inner surface of the bone could be found, but the part which lay in apposition with the abscess was blackened. The temporal bone, which was kept in Müller's fluid, was examined by myself and Dr. Spitzka, everal months afterwards.

No evidence of necrosis of the surface of the bone; that portion corresponding to the eminences of the cochlea and superior semicircular canals, perfectly normal in consistency and appearance. Perforation of the membrana tympani in its anterior inferior quadrant. The portion of membrane still existing seemed to be only newly formed connective tissue (probably healed perforation). The auditory canal was opened by sawing in an anterior posterior direction, just in front of the attachment of the drum-membrane, when a small purulent cavity, situated above and behind the tympanum, and communicating with the latter immediately behind the attachment of the membrana tympani, was laid open. No ossicles were present. The mucous membrane was thickened and covered the promontory. The latter was smooth and healthy. At the posterior portion of the necrotic bone and purulent mass lies the facial nerve, which is softened and diminished in volume, while above this point it is quite healthy. The tendon of the tensor tympani was attached to the thickened part of the mucous membrane in its upper portion. The cochlea was opened into by a strong knife. The modiolus was entirely destroyed except at its base; the septum between the three coils was preserved. The soft parts of the vestibule were entirely wanting. The

horizontal semicircular canal was absent; the anterior vertical one contained pus, but was still lined by membrane. The superior vertical contained pus, but no lining membrane.

The walls of the vestibule and the bony canals were smooth and surrounded by ivory healthy-like bone. Both the saccule, utricule and superior and horizontal canals absent; membranous part of the anterior canal present, but bathed with pus, which extended into the vestibule. A bristle passed into the aquæduct of the vestibule failed to reach the surface of the bone. The internal auditory meatus was examined; both nerves at this point healthy, all the other parts of the canal being healthy.

No trace of a necrotic path communicating with the cavity of the skull could be found. The abscess of the cerebellum was probably not of recent origin, since it had such a well marked thick pyogenic sac. Is it not probable that each of the oft recurring attacks of pain, to which the patient referred, were due to cerebral irritation which lasted for a few days and then passed away, but finally by repeated attacks gave rise to the formation of an abscess?

Another point of interest is the simultaneous existence of labyrinthine and cerebellar disease. I made the diagnosis of the seat of the intracranial disease from the vertigo and unsteadiness of gait. May this, however, not just as well have been caused by the disease of the semi-circular canals? I am sorry that I did not notice more particularly whether the staggering in walking was towards the affected side, as this might have enabled me to have included the probability of the inner ear being disorganized in my diagnosis. But I only saw the patient once before she took to her bed, and then forgot to make the inquiry.

CASE OF TREPHINING OF THE MASTOID IN ACUTE SUPPURATIVE OTITIS MEDIA. PERFECT AND UNUSUALLY RAPID RECOVERY.

By H. Knapp, M. D., *of New York.*

The case which I beg to communicate may serve to extend, as far as a single case goes, the indications for trephining the mastoid process. I do not, of course, consider it unique, but similar cases are certainly not yet so numerous as to lose their interest. In an acute otitis media, there was, *without diminution of the discharge*, excruciating headache and tenderness and puffiness of the mastoid region. By the trepanation of the mastoid pus was liberated, the patient's headache relieved at once, and the membrana tympani restored in two weeks. The opening in the mastoid closed in 4 weeks, and the hearing was normal again in 6.

If this outline has sufficiently awakened your interest, I will proceed and give you the particulars of the case in a short description.

G. V., a ship engineer, aged 37, of New York, consulted me, April 2, 1879. Four weeks previously, on a very cold day, he stood in a draft near the open door of his steamer, and contracted a severe naso-pharyngeal catarrh, with pain in his head and his left ear. He remained in bed for a few days, perspired, and felt better. He went out again, felt worse after it, and his ear began to discharge. He continued his work, and the earache and discharge persisted. In the fourth week after the exposure he had, besides, severe headache every night. When I saw him, I found his pharynx red and swollen, the mastoid and upper cervical region of the left side tender, red and moderately swollen, an abundant quantity of good pus in the left auditory meatus, the walls of the inner third of which were red and swollen, the drum-head largely perforated, and the mucous membrane of the drum-cavity tumefied. Inflation through the tube not possible. $h=0$; $v=\frac{5}{60}$. Bone conduction

for watch lost; for Politzer's hammer preserved. Air conduction for Politzer's hammer lost. Right ear normal.

I advised him to enter the N. Y. Ophthalmic and Aural Institute. He went there at once, viz:

April 2d. His ear was steamed in the evening; he felt relieved, and slept well.

April 3d. The steaming was repeated in the morning. During the day, violent headache with shooting pain through the left side of head. Physical condition of ear and surroundings the same; discharge from ear copious. The pain in ear and head temporarily relieved by steaming in the evening. He passed a bad night.

In the morning of *April 4th* he felt somewhat better; in the afternoon his headache was intense again.

Since his symptoms were remitting only for short intervals, and the swelling and tenderness behind the ear clearly indicated that the mastoid was involved in the suppurative process, I thought that the persistent violent headache in spite of the continuance of a copious discharge from the ear, was, without any other cerebral symptoms, sufficient to warrant the supposition of retention of pus in the mastoid, and to justify the opening of that bone. As in the night from the 4th to the 5th of April there had been no remission, and the symptoms during the day were rather aggravated, I performed the operation on *April 5th*, at 4 P. M., under ether, with the kind assistance of Drs. P. R. Pooley and R. O. Born.

Incision over mastoid process from above downward, about 3‴ behind auricle, 1″ in length. Periosteum divided and pushed aside. The bone hard over the whole process, and pressure or cutting with a strong knife was not sufficient to break it down. Dr. Buck's drill was inserted into the small depression of the bone, which was situate immediately above the level of the upper wall of the meatus, in the line of the wound. After turning the instrument several times to and fro, its point entered the cavity. As soon as it

was withdrawn, a large quantity of fluid pus flowed from the perforation. The hole was enlarged with a gouge, and the cavity explored with a probe. The inner wall offered the distinct resistance of hard bone; but in one place, almost opposite the perforation, the wall felt soft and yielding (sinus?). No granulation tissue was in the cavity, but some cheesy material was removed with the spoon. A piece of carbolized perforated rubber tube was introduced, and a simple charpie-flannel bandage applied.

In the evening the patient was free from pain. There was a burning sensation in the wound, and a sanguinolent discharge.

April 6th. Patient passed a good night. No headache. A silver tube with a frange—a lachrymal canula—was substituted for the rubber tube. Discharge purulent.

April 7th. Night less good; pain from pressure when lying on left side. Ordered morph. sulph. 0.015 at bedtime.

April 8th. Slept well. Canula removed and cleansed twice daily. Discharge from meatus wiped out with cotton-wool on dentist's holder.

April 10th. No change. Patient feels comfortable. By syringing a few flakes from the ear. Wound cleansed with Anel's syringe. Pain when water enters the cavity.

April 12th. No discharge from meatus. Otherwise status idem.

April 14th. Since the syringing of the mastoid cavity always caused a good deal of pain, and the pus flowed freely through the canula, the syringing was discontinued. The cavity, explored every now and then with a probe, showed no abnormal contents. The swelling over the mastoid process had considerably decreased, and the canula had to be shortened accordingly.

April 20th. No further reaction. Very slight swelling over mastoid process, none in neck. Granulations covering the wound removed. Opening in bone still large, discharge

copious. No discharge from auditory meatus. *Drum-membrane restored!*

April 21*st*. Silver tube left off.

April 26*th*. Discharge still copious; pus bonum et laudabile.

April 30*th*. Discharge from wound less. Granulations cut off. Patient dismissed from hospital.

May 7*th*. Wound of mastoid permanently healed. No inconvenience.

May 16*th*. No pain in ear, no headache, no noises, no tenderness on pressure. Manubrium mallei reddish. Relief of membr. tymp. normal. h. $\frac{4}{24}$ v. (whisper) $\frac{20}{20}$.

A CASE OF PURULENT INFLAMMATION OF THE MIDDLE EAR ACCOMPANIED BY FACIAL PARALYSIS.

By Clarence J. Blake, M. D., *of Boston.*

The patient, a young lady 17 years of age, first came under my care Oct. 15, 1875, for relief from a purulent discharge from the right ear. At five years of age she had, with a severe attack of scarlet fever, purulent inflammation of both middle ears, accompanied by profuse otorrhœa, which ceased two years later under treatment at the hands of the late Dr. E. H. Clarke.

On examination on the date above given, there was found in the right ear a large perforation, including nearly two-thirds of the membrana tympani; the mucous membrane of the tympanic cavity was red, slightly swollen and secreting freely. The Eustachian tube was not readily pervious on inflation; the faucial mucous membrane, especially on the right side, was much congested, and there was also considerable enlargement of the right tonsil.

In the left ear there was a fairly tense cicatrix, representing somewhat more than two-thirds of the membrana tympani, and through this cicatrix, at its upper margin, could be distinctly seen a whitish body, suggesting in size and shape the body of a displaced incus.

The hearing for the watch in the right ear was $\frac{2}{1\,8\,0}$, and in the left ear $\frac{5}{1\,8\,0}$; the tuning-fork held between the teeth was heard better in the left ear, and the hearing for high musical tones was also better in the left ear than in the right. Under treatment, which consisted in astringent applications to the throat, Politzer's inflation, the internal administration of tonics, and for the right ear, syringing and astringent instillations, the hearing for the watch increased; in the right ear to $\frac{7}{1\,8\,0}$, and in the left ear to $\frac{1\,8}{1\,8\,0}$.

In April, 1876, the same trouble occurred in the right ear, and was similarly treated with similar results. On discharging the patient from treatment on this occasion, she was especially warned against imprudent exposure to the weather, and especially against sea-bathing, on account of the ready liability to the recurrence of severe trouble in either ear.

In September, 1878, after an unwonted exposure to a cold night wind and fog, she had a severe pain in the left ear, followed within forty-eight hours by a muco-purulent discharge. With the appearance of this discharge, however, the pain, which she located in the depth of the ear, did not cease, but continued almost unabated, except for intervals of comparative relief, for nearly seven weeks. When most severe, the pain extended to the mastoid region and over the corresponding side of the face.

The discharge from the ear became more decidedly purulent and increased in quantity, and at the end of the third week a slight drawing of the angle of the mouth was noticed. A week later this paralysis was greater, and there was some difficulty in speaking—"as if the tongue were swollen." The family physician, on examining the ear, detected polypus, and advised its removal, but not being pre-

pared to treat the case himself, the patient came to Boston and was seen on the last of November. There was total paralysis of all motor branches of the left facial and absolutely no control of will over any of the muscles; the left eye remained open nearly one centimetre, and the tears ran down upon the cheek. Taste was wanting on the left tip of the tongue.

On examination of the left ear, there was found a bright red mass filling the posterior portion of the inner end of the canal. This mass bled easily and freely under traction with the forceps, so much so that any attempt to raise it for the purpose of measuring it, was rendered futile by the copious flow of blood; its origin, however, was determined as the posterior portion of the tympanic cavity. The ear was not particularly sensitive to pain, but pressure upon the mass with a probe, or even pressure upon the region in front of the ear, caused severe vertigo; the latter symptom had been observed before her coming to Boston. The treatment consisted in the use of astringent instillations with gentle syringing, forcible syringing being not only unnecessary, but causing severe vertigo; application of the muriate tincture and of persulphate of iron to the mass. Tonics internally, massage to take the place of exercise, which the weather would not permit, and bromide of potassium at night. Under this treatment the case seemed to be progressing favorably, when with the appearance of the menses, accompanied by slight dysmenorrhœa, the pain in the ear recurred; being worse at night and accompanied by more or less continuous vertigo, and it became necessary to suspend for a time all local treatment. At the end of ten days, the disturbing symptoms had greatly abated; but while the local aural trouble was apparently no worse, the patient was greatly prostrated. To this the unaccustomed confinement in a city boarding-house probably somewhat contributed, and the patient was sent to friends in the country, where she remained until late in March; returning to Boston greatly improved in

general condition, free from pain or vertigo, with but slight discharge from the ear and with the polypoid mass greatly diminished in size, the local treatment during this period having consisted in syringing and the application of powdered alum. The facial paralysis remained the same. The subsequent treatment of the ear consisted in a renewal of the local application of iron solution, the growth rapidly shrunk away, the discharge ceased, and the hearing for the watch improved to $\frac{12}{180}$.

On the sixteenth of April the patient was placed in charge of Dr. S. G. Webber of Boston for treatment of the facial paralysis, her previous condition and her absence in the country having precluded the possibility of the desirable earlier resort to electricity for relief.

On examination, Dr. Webber found the Faradic reaction entirely gone and the galvanic reaction retained only in a few muscles about the angle of the mouth. Under continued use of the galvanic current, the muscles began to respond somewhat better, and on May 5th there was a slight trace of voluntary control over the muscles of the mouth. The patient continued to improve under treatment, taste returned to the tongue, the motor power increased, the muscles of the mouth which had recovered voluntary power regained some response to the Faradic current, and the reaction of the nerve was partially restored, but was easily exhausted on stimulation—responding only two or three times to a strong current.

When finally discharged from treatment, early in June, the eye could be closed to about three millimetres, the corrugator muscle had not recovered, and the Faradic current had no action on the muscles of the eyelid. There was slight diminution of sensation over the face, but decided hyperæsthesia of the forehead to both the electric current and to touch. The æsthesiometer gave perception over the right cheek bone at $\frac{7}{16}$ inch and over the left cheek bone at $\frac{10}{16}$ inch; on the forehead, on both sides, $\frac{7}{16}$ inch. Since the

patient's return to her home, and up to the present date, there has been no recurrence of the aural trouble, of pain or vertigo, and there has been a gradual though slight improvement in the voluntary control of the facial muscles.

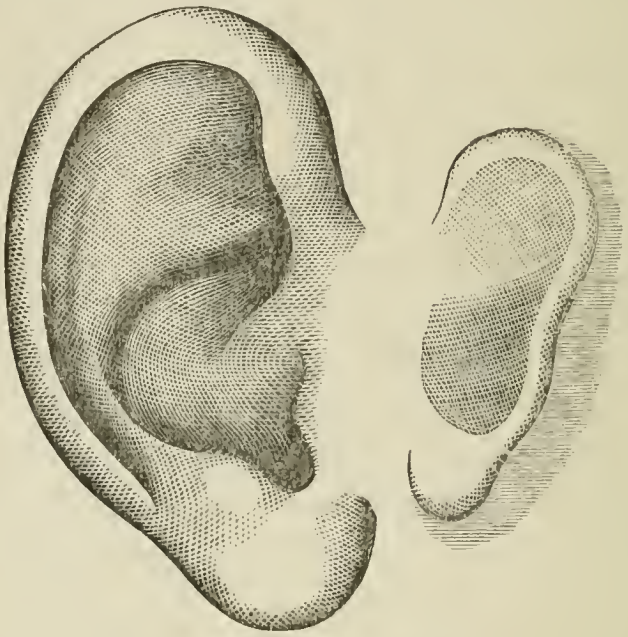
The case is interesting in regard to the location of the polypoid growth and the symptoms evoked in connection with the observations of Politzer on the occurrence of openings in or thinning of the bony wall of the facial canal, in relation also to a previous and evidently severe inflammatory process within the tympanic cavity, which may in its results have paved the way for the peculiar symptoms occurring with the later disease, and also of interest as concerns the degree of recovery attained after a facial paralysis existing for so long a period, as shown by the results of the treatment as above given, for which I am indebted to the notes of the case placed at my disposal by Dr. Webber.

A CASE OF SUPERNUMERARY AURICLE OF RUDIMENTARY DEVELOPMENT. (Polyotia.)

By Dr. H. Knapp, *of New York.*

In May, 1879, a man, Hebrew, aged 40, presented himself at the Dispensary of the N. Y. Ophthalmic and Aural Institute, with an irregular cutaneous appendix in front of his right ear and a dermoid tumor on the outer sclero-corneal region of his left eye. Both ears were well developed, and he had never had any difficulty in hearing. The cutaneous appendix in front of the right ear was situated 3 Mm. before the base of the tragus, and its line of insertion stretched in a slight curve, with the concavity backward, in front of the ear, about 35 Mm. in length. It represented a puckered up piece of skin, which, by unfolding, showed a larger upper portion, rising about 20 Mm. over the surface of the skin,

a depressed middle, and a smaller lower portion. In the upper and middle portions hard substances, feeling like cartilage, were enclosed, while the lower had a uniform softish consistence. The appendix, when spread out, had



the appearance of a misshapen auricle, and the cartilage which was present in the upper and middle portions, but not in the lower, made it still more probable that I had to deal with a pinna and lobule.

The disease was congenital, and though there was no indication of a second ear-canal, nor any other sign of duplicity in the organ of hearing, I pronounced it a supernumerary auricle of rudimentary development, and advised the patient to have it removed, to which he gladly consented.

I cut the whole mass cleanly off and united the wound of the skin by ordinary sutures. The recovery was without suppuration, and scarcely left a mark. The patient was delighted with the result. He had worn his hair long, a curl falling coquettishly in front of each ear, covering the deformity. When he presented himself again, his hair was cut short and the curls were sacrificed.

Mr. President and Gentlemen,—I place the specimen, greatly shrunken in alcohol, before you. You will notice the cartilage in the upper and middle portions and the purely fibrous structure in the lower, which corresponds to the lobule.

The dermoid tumor on the outer part of the corneo-scleral junction was also removed. It was about 10 Mm. in diameter, one of the largest I have seen. It was a dermoid tumor containing hairs, sebaceous glands, connective tissue and epithelium. It was also congenital, and I mention it here, since these dermoid tumors are also considered as duplicate organs, namely, as a fourth eyelid.

In consulting the modern text-books of otology, from Wilde to Schwartze, I have not been able to find a similar observation. The case evidently belongs to the class of malformations which are described by Virchow and others under the name of "auricular appendages," (polyotia.) The appendages consist, like our specimen, of skin, subcutaneous tissue, and reticular cartilage. They commonly are wart-like, or larger elevations in front of the ear, mostly single, sometimes double and even triple. Such appendages I have repeatedly seen, but none was so large and imitating so unmistakably the shape and also the structure of the auricle—pinna and lobule—as the one here described.

ON THE USE OF PERMANGANATE OF POTASSA IN CHRONIC OTORRHŒA.

By Lucien Howe, *of Buffalo, N. Y.*

So many different substances have been recommended for chronic otitis media purulenta, that it would seem unnecessary to add to the number.

The one to which I would call attention, however, is so

frequently employed for similar purposes in other portions of the body, that there can be nothing new in its application to the ear. It has been incidentally referred to in this connection by Burnett, but I am not aware that Von Tröltsch, Grüber, Toynbee, Roosa, Allen or any other writers consider it at all efficacious. It would be strange, however, if, among the numerous astringents or caustics used for this purpose, so reliable an agent as the permanganate of potassa had not already been thoroughly and systematically tested.

I simply propose, therefore, to cite a few cases in which it has been tried, and compare the result with that obtained in the employment of other agents. For this purpose I have collected from my case books the records of 53 individuals thus treated. Several others were noted, which would have been included in this list but for the fact that the records were not completed, or that the patients were lost sight of before any definite conclusions could be arrived at. The age of the patients ranged from 2 to 44 years, and the disease had lasted with greater or less variation from 3 weeks to 22 years. In several instances where the otorrhœa followed a primary acute otitis media purulenta, it was not easy to say when the discharge had passed into a condition to deserve the term "chronic." I have, therefore, excluded all cases in which the disease has not lasted at least three weeks, or which were still characterized by pain and other symptoms which would entitle them to the term "acute."

Concerning the etiology of these cases, there was about the same variety that one would expect in a series chosen at random. Scarlatina furnished the usually large quota of almost half, or, more exactly, 21. Seven followed primary acute otorrhœa. Two resulted from measles, and a number were dependent upon causes which it was impossible to ascertain.

The principal treatment presented in all of these was the use of a solution of the permanganate of potassa in water. In the milder cases, two grains to the ounce was found to be

sufficient; but if more serious or of very long duration, the strength was increased to four, six, or even eight grains to the ounce. The patients were simply instructed to syringe out any accumulated secretion with tepid water and then pour a few drops of the fluid into the ear. This was allowed to remain five or ten minutes, if it produced no smarting or burning sensation. If decided inconvenience was produced, however, it was washed out sooner.

When the discharge was at all abundant, this was repeated twice daily; and if very profuse, of course the ear was kept clean by more frequent washings with water alone.

Whenever polypi were developed, as was the case in three instances, or any other complications presented, they were treated by the usual methods. A sufficient time has now elapsed to count with a moderate degree of certainty on the effects produced, and, as a result, I find of the 53 cases, 40 have entirely recovered in an average time of 38 days. In 6 the discharge occurs at intervals. In 4 it continues, but lessened as to quantity and the fœtid character of the odor. In 3 it still persists.

Now, comparing this treatment with those methods usually placed foremost in the text books, I find the results are decidedly in its favor. In 7 of those cases, nitrate of silver had been used after the manner recommended by Schwartz, and, although an improvement was manifest in most of them, the progress was not as rapid as under the use of permanganate of potassa. Moreover, in 10 other cases treated with nitrate of silver, the discharge was arrested in 6 after an average of 51 days. Two persisted in the treatment about six months and 3 disappeared, while concerning 2 the record is imperfect.

In 3 of the cases reported I began by using sulphate of copper, but, after an average of six days, changed to the permanganate of potassa, and improvement followed quite as rapidly, to say the least, as before. Again, in 5 other cases, treated with sulphate of copper alone, I find on the

average the discharge continued for 63 days. Sulphate of zinc, alum and tannic acid, carbolic acid and other remedies also have been used in other cases, but the record concerning them is not sufficiently definite to warrant any exact statement.

There are obvious objections against drawing any very positive conclusions from the data here given, to which it is only fair to direct attention. The principal one is, that the number of cases reported is quite limited. Again, it is probable that many cases of otitis media purulenta will yield to the use of almost any astringent, or of water alone, if persistent effort is long continued. In spite of the objections, however, the facts just cited seem to indicate, that in the permanganate of potassa we have a remedy quite as efficacious, if not more so, than those upon which reliance is usually placed. It has, in addition, certain advantages which would appear to make it preferable to most other applications. Unlike the strong solutions of nitrate of silver, it can easily be used by the patient, and is not followed by as much smarting or pain. Especially is it to be preferred for the antiseptic or deodorizing quality by which the fœtid smell of the secretion is removed to an extent not observed in the use of any other application, not excepting carbolic or salicylic acid.

It is probable that a more extended experience may produce a modification of these views, but as an inference from a limited number of cases, it seems worthy of mention.

TRANSACTIONS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

THIRTEENTH ANNUAL MEETING,

Newport, R. I., July 21, 1880.

VOL. 2. PART 4

BOSTON:
A. WILLIAMS & CO., 283 WASHINGTON STREET.
1880.

NEW BEDFORD:

PRINTED BY THE MERCURY PUBLISHING COMPANY.

☞ *Copies of Transactions of former meetings can be obtained by addressing the Secretary, Dr. J. J. B. Vermyne, 174 Union street, New Bedford, Mass., or the publishers, A. Williams & Co., 283 Washington street, Boston, Mass.*

CONTENTS.

PAGE.

Members of the American Otological Society..... 367

Minutes of the Thirteenth Annual Meeting (1880)..... 369

A Case of Aneurism of the Middle Meningeal Artery from Traumatism. By Dr. H. N. Spencer. St. Louis, Mo..... 374

Osteo-Sclerosis of the Mastoid, (specimen) with a history of the case. By Dr. J. O. Green. Boston, Mass..... 379

On the Ear Affections of Inherited Syphilis. By Dr. C. J. Kipp, Newark, N. J..... 390

On Branchial Fistulæ at the External Ear. By Dr. C. J. Kipp, Newark, N. J..... 402

Some Remarks and Observations on Bone Conduction. By Dr. H. Knapp. New York, N. Y..... 407

Verbal Communications. Exhibition of Pathological Specimens.. 416

Phlebitis of Lateral Sinus and Emissary Mastoid Vein. By Dr. J. O. Green. Boston. Mass..... 416

Necrosis of Inner Table of the Mastoid. By Dr. J. O. Green... 416

Exfoliated Pieces of an Osseous Labyrinth. By Dr. C. J. Blake, of Boston, Mass..... 417

Exostosis in the Ear Canals of the Mound-builders. By Dr. C. J. Blake..... 417

Exhibition of Instruments..... 420

Modification of Politzer's Air-bag. By Dr. J. O. Green, of Boston, Mass..... 420

Instrument for the Removal of Epithelial Masses. By Dr. E. D. Spear, Jr., Boston, Mass. Presented by Dr. C. J. Blake. 421

Aural Syringe (wood cut). By Dr. O. D. Pomeroy, New York. N. Y..... 421

Drop Tube and Powder Blower for treatment of the Middle Ear (wood cuts). By Dr. J. A. Andrews, of Clifton, Staten Island, N. Y..... 422

On the use of Common Salt as a Cleansing Solution in Otitis Media Purulenta with Perforated Membrana Tympani. Suggestion by Dr. J. Green, of St. Louis, Mo..... 423

MEMBERS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

HONORARY MEMBERS.

PROF. A. GRAHAM BELL.....Cambridge. Mass.
PROF. ALFRED M. MAYER.....Hoboken, N. J.
PROF. OGDEN N. ROOD.....New York, N. Y.

ACTIVE MEMBERS.

Dr. FRANK W. ABBOTT.....Buffalo, N. Y.
Dr. CORNELIUS R. AGNEW.....New York, N. Y.
Dr. J. A. ANDREWS.....Clifton, St. Isl., N. Y.
Dr. EDWIN W. BARTLETT.....Milwaukee, Wis.
Dr. CLARENCE J. BLAKE.....Boston, Mass.
Dr. R. C. BRANDEIS.....New York, N. Y.
Dr. ALBERT H. BUCK.....New York, N. Y.
Dr. CHARLES H. BURNETT.....Philadelphia, Pa.
Dr. JOHN H. DIX.....Boston, Mass.
Dr. EZRA DYER.....Pittsburg, Pa.
Dr. EDWARD T. ELY.....New York, N. Y.
Dr. JOHN GREEN.....St. Louis, Mo.
Dr. J. ORNE GREEN.....Boston, Mass.
Dr. EMIL GRUENING.....New York, N. Y.
Dr. EDWARD L. HOLMES.....Chicago, Ill.
Dr. E. E. HOLT.....Portland, Me.
Dr. LUCIEN HOWE.....Buffalo, N. Y.
Dr. SAMUEL J. JONES.....Chicago, Ill.
Dr. CHARLES J. KIPP.....Newark, N. J.
Dr. HERMAN KNAPP.....New York, N. Y.

Dr. William S. Ludlum.....Morris Plains, N. J.
Dr. Arthur Mathewson.....Brooklyn, N. Y.
Dr. Read J. McKay.....Wilmington, Del.
Dr. C. S. Merrill.....Albany, N. Y.
Dr. H. G. Miller.....Providence, R. I.
Dr. Henry D. Noyes.....New York, N. Y.
Dr. J. F. Noyes.....Detroit, Mich.
Dr. Oren D. Pomeroy.....New York, N. Y.
Dr. Thomas R. Pooley.....New York, N. Y.
Dr. J. S. Prout.....Brooklyn, N. Y.
Dr. William Rankin.....Newark, N. J.
Dr. Charles E. Rider.....Rochester, N. Y.
Dr. D. B. St. John Roosa.....New York, N. Y.
Dr. John D. Rushmore.....Brooklyn, N. Y.
Dr. William W. Seely.....Cincinnati, O.
Dr. Samuel Sexton.....New York, N. Y.
Dr. Henry L. Shaw.....Boston, Mass.
Dr. Francis Simrock.....New York, N. Y.
Dr. Nelson B. Sizer.....Brooklyn, N. Y.
Dr. H. N. Spencer.....St. Louis, Mo.
Dr. George T. Stevens.....Albany, N. Y.
Dr. George Strawbridge.....Philadelphia, Pa.
Dr. Samuel Theobald.....Baltimore, Md.
Dr. William Thomson.....Philadelphia, Pa.
Dr. Charles A. Todd.....St. Louis, Mo.
Dr. J. J. B. Vermyne.....New Bedford, Mass
Dr. David Webster.....New York, N. Y.
Dr. E. Williams.....Cincinnati, O.

THE AMERICAN OTOLOGICAL SOCIETY.

MINUTES FOR 1880.

NEWPORT, R. I., July 21, 1880.

The Society met at the Masonic Building at 10.45 A. M. The President and Vice-President being absent, the meeting was called to order by the Secretary, and Dr. J. Orne Green was elected President pro tem.

Present :—

DRS. JOHN GREEN	St. Louis, Mo.
O. D. POMEROY	New York, N. Y.
C. J. BLAKE	Boston, Mass.
H. KNAPP	New York, N. Y.
C. J. KIPP	Newark, N. J.
A. MATHEWSON	Brooklyn, N. Y.
J. J. B. VERMYNE	New Bedford, Mass.
H. N. SPENCER	St. Louis, Mo.
LUCIEN HOWE	Buffalo, N. Y.
SAMUEL SEXTON	New York, N. Y.
C. R. AGNEW	New York, N. Y.
D. WEBSTER	New York, N. Y.
J. A. ANDREWS	Clifton, S. I., N. Y.
E. WILLIAMS	Cincinnati, O.
J. S. PROUT	Brooklyn, N. Y.
E. E. HOLT	Portland, Me.

And by invitation :—

DRS. W. H. CARMALT	New Haven, Conn.
W. R. BIRDSALL	New York, N. Y.
S. B. ST. JOHN	Hartford, Conn.
A. G. HEYL	Philadelphia, Pa.

The records of the Second Session of the last meeting were read and approved.

The President appointed as the Business Committee, Drs. John Green, A. Mathewson and D. Webster.

The Treasurer's Report was read and referred to Drs. O. D. Pomeroy and J. S. Prout, as Auditing Committee.

The Committee on Membership made a report recommending the election of

Drs. Edward T. Ely, of New York, N. Y.
R. C. Brandeis, of New York, N. Y.
Samuel Theobald, of Baltimore, Md.
J. A. Andrews, of Clifton, Staten Island, N. Y.
Read J. McKay, of Wilmington, Del.
E. E. Holt, of Portland, Me.

and for Honorary Membership, of

Prof. A. Graham Bell, of Cambridge, Mass.

who were all elected on separate ballots.

The resignation of Dr. J. H. Hinton was offered and accepted.

The following nominations for Membership were then read :—

Dr. W. H. Carmalt, of New Haven, Conn.
Proposed by Drs. Kipp and Sexton.
Dr. D. C. Gamble, of St. Louis, Mo.
Proposed by Drs. Spencer and Sexton.
Dr. F. B. Loring, of Washington, D. C.
Proposed by Drs. St. John Roosa, and Vermyne.
Dr. S. B. St. John, of Hartford, Conn.
Proposed by Drs. Buck and Webster.
Dr. Richard A. Reeve, of Toronto, Can.
Proposed by Drs. Blake and Agnew.
Dr. Stephen O. Richey, of Washington, D. C.
Proposed by Drs. Jones and Pomeroy.

An amendment to the By-Laws was proposed by Dr. Vermyne, to repeal Section VI, "Special Committee on Progress

of Otology," which had become superfluous by the action of the Society at the last annual meeting.

The Auditing Committee reported the Treasurer's accounts correct, and his report was then, on motion, accepted.

The Business Committee reported the following Order of Business :—

I. Papers previously announced in the notice of annual meeting.

II. Some Remarks and Observations on Bone Conduction, by Dr. H. Knapp.

III. Exhibition of Specimens, by Dr. C. J. Blake.

IV. Exhibition of Instruments, by Drs. Pomeroy, J. Orne Green and Andrews.

The gentlemen present by invitation were invited to take part in the discussions.

The first paper was read by Dr. H. N. Spencer, of St. Louis, Mo. : A case of Aneurism of the Middle Meningeal Artery from Traumatism.

Discussed by Drs. Kipp, Agnew and J. Orne Green.

Next in order was :—

Exhibition of Phlebitis of Lateral Sinus and Emissary Mastoid Vein ; Exhibition of Necrosis of Inner Table of the Mastoid ; and Osteo Sclerosis of the Mastoid, with the history of the case ; all by Dr. J. Orne Green, of Boston, Mass.

Discussed by Drs. Mathewson, Knapp, Agnew, Spencer, Sexton and Pomeroy.

Dr. C. J. Kipp, of Newark, N. J., read the following papers :—

1. On the Ear Affections of Inherited Syphilis.

2. On Branchial Fistulæ at the External Ear.

Discussed by Drs. Knapp, Agnew, Williams, J. Green, J. Orne Green, Blake, Sexton and Pomeroy.

Dr. J. Orne Green exhibited a modification of Politzer's Air-bag.

At 1.45 P. M. the Society adjourned to 7.30 P. M.

Second Session.

The Society was called to order at 7.45 P. M., Dr. J. Orne Green in the chair.

The minutes of the first session were read and approved.

Dr. H. Knapp, of New York, N. Y., read a paper entitled: Some Remarks and Observations on Bone Conduction.

Discussed by Drs. Blake, Pomeroy, Kipp, Andrews and J. Green.

Dr. C. J. Blake, of Boston, Mass., exhibited a specimen of dead bone, containing portions of the cochlea, labyrinth and semi-circular canals, with remarks about the case; and made a verbal communication on exostoses in the external meatus of crania from mound builders, illustrated by photographs.

Discussed by Drs. Pomeroy, Williams and Webster.

Dr. Blake also exhibited an instrument devised by Dr. Spear, of Boston, for the removal of masses of epidermis in keratosis.

Dr. O. D. Pomeroy, of New York, N. Y., exhibited an aural syringe, and Dr. J. A. Andrews, of Clifton, Staten Island, N. Y., two instruments for the application of fluid or pulverized medicine to the tympanic cavity through a perforated membrana tympani.

Dr. J. Green, of St. Louis, Mo., offered some suggestions, favoring the use of weak solutions of common salt as cleansing injection in cases of Otitis Media Purulenta with Perforation of Drum-membrane.

Remarks were made by Drs. Kipp, Pomeroy, Prout and Webster.

The Amendment to the By-Laws, proposed at the first session, to repeal Section VI., "Special Committee on Progress of Otology," was put to vote and carried.

The Business Committee reported the following list of officers for the ensuing year:—

President	Dr. J. Orne Green.
Vice President	Dr. J. S. Prout.
Secretary and Treasurer	Dr. J. J. B. Vermyne.
Committee on Publication	Dr. J. J. B. Vermyne, Dr. C. J. Blake, Dr. J. O. Green.
Committee on Membership	Dr. C. J. Blake, Dr. O. D. Pomeroy, Dr. John Green.

who were elected.

The Committee also reported for time and place of next meeting, the day preceding that to be appointed for the next meeting of the American Ophthalmological Society and the same place. Carried.

It was moved that manuscripts be sent to the Secretary on or before Sept. 15th, and that this, as also the previous rules in regard to revision and returning of proofs, be made a standing order. Carried.

By vote of the Society the assessments due by Dr. W. S. Ludlum were remitted on account of physical disability.

Dr. J. S. Prout moved that in printing the list of members also their office hours should be mentioned. Carried.

After reading of the minutes of the Second Session, they were approved, and at 9.45 the Society adjourned.

J. J. B. VERMYNE, *Secretary.*

A CASE OF ANEURISM OF THE MIDDLE MENINGEAL ARTERY, FROM TRAUMATISM.

By H. N. Spencer, A. M., M. D., *of St. Louis, Mo.*

In the latter part of November, 1878, Mr. C. W., aged 26 years, went out with a sheriff's posse to make an arrest of a desperado. The company was waylaid and fired upon. Mr. W. fell and is the subject of this interesting disorder which I have to present to you.

He came to me May 10, 1880, at the instance of his family physician. He presented a high degree of deafness; but the object of his visit was more to get rid of a peculiar noise in the left ear, of very distressing character.

The case has excited considerable interest in certain quarters, and has been diagnosticated as one of traumatism of the labyrinth, so that I shall take the liberty of presenting a review of the case with the line of argument by which I reached an exclusion of this organ from any complicity in the situation. The fire was received on the left side from a a double barrelled gun loaded with buck shot. The single ball which gave rise to this trouble, which makes his case of interest to us, entered on the left side of the head at a point three-quarters of an inch below and seven-eighths of an inch in front, measured from a central point on the floor of the meatus at its external orifice, and emerged on the opposite side of the head just in front of the tragus, central with the external auditory canal. This, to start with, precludes the possibility of any *direct* injury having been done to the labyrinth. The *history* of the case refers to a cold heavy atmosphere following a day of rain. The subject of the in-

jury fell from his horse and lay upon the wet ground for an indefinite period of time, which he thinks must have been from one to two hours, before he was recovered by his companions. He was carried on an open wagon for a distance of several miles to the village, without more covering for his thoroughly chilled body than the dress which he had worn from home. There was no arterial hemorrhage. The bleeding was considerable, and especially annoying as it came into his mouth. The noise of which he complains commenced three or four days after the injury was received. At first it was feeble. It has been the same character of noise, only increasing in intensity, from then till now.

There has been no labyrinthine vertigo, nor disturbance of the function of equilibration.

The deafness did not develop until some time subsequent to the injury. The hearing was not in the slightest degree impaired, so far as Mr. W. can remember, for from three to five weeks, and it has been a progressive trouble, gradually attaining its present magnitude.

The *examination* revealed the drum-heads intact, very much sunken and opaque. The naso-pharyngeal mucous membrane very red and œdematous. The hearing was: left $\frac{1}{2}$ of $\frac{1}{80}$, right $\frac{2}{80}$. The tuning fork was heard more distinctly on the left side. The diagnostic tube inserted in the left meatus brought to my ear with remarkable clearness the noise which distressed the patient. It occurred to me at first that it might be due to an interruption of the circulation in the carotid canal, from a deflection of bone or a fibrinous deposit, the noise being synchronous with the pulse. But on more careful consideration this view of the case was abandoned. If the noise had had its origin in either of these conditions we should have had a well defined termination to the sound produced, whereas the aneurismal bruit was unmistakable.

If we needed further evidence of the absence of trauma-

tism of the labyrinth, we have it in the result of treatment. While he was under my care the hearing increased on the left side from $\frac{1}{2}$ of $\frac{1}{8\,0}$ to $\frac{6}{8\,0}$, and on the right side from $\frac{2}{8\,0}$ to $\frac{3}{8\,0}$. The improvement it will be observed being more marked on the *left* than on the right side, so that the left became now the better ear, and the tuning fork again placed on the vertex was perceived more distinctly by the right ear—just the reverse of the observation which was made at the time of his first visit.

It is conclusive that his deafness has been wholly due to a chronic catarrhal inflammation of the middle ear, originating in a cold which was contracted probably at the time when he lay upon the wet ground after the gun-shot wound. His cold would have been further complicated by the injury, which must have been done to the naso-pharyngeal tissues, and this probably facilitated the extension of inflammation to the middle ear.

The course of the ball entering just in front of the (spheno-maxillary) articulation must have passed against the posterior surface of the middle meningeal artery, a little below its point of entrance into the foramen spinosum on a level with the union of the atlas and the axis (only obliquely) and must have passed through the tissues of the posterior wall of the pharynx.

The distinct conduction of the sound makes it probable that the aneurism is contiguous to the solid bony wall of the cranium.

I shall hope to be able to report further on this case at some future time.

DISCUSSION.

Dr. Charles J. Kipp of Newark, remarked that he had had a similar case under observation during the past two years, occasioned by a fall upon the back of the head. The

patient complained of a noise in the head, and with a stethoscope Dr. Kipp could hear the noise. He suspected aneurism, as the noise could be stopped by pressure upon the carotid artery. Hearing was not at all impaired.

Dr. Spencer said that it was also true, in his case, that by pressure the noise could be arrested.

Dr. Agnew did not think that the existence of the trouble for two years precluded the possibility of aneurism, for there was no standard by which to measure the duration of aneurism. He threw out this remark as a suggestion without committing himself to any opinion.

Dr. Kipp further remarked that the noise had diminished very much of late, and he therefore doubted the existence of an aneurism in his case.

Dr. Agnew replied that that might be possible owing to deposits in the tissues, thus diminishing the bruit.

Dr. J. Orne Green remarked that the Society would perhaps remember two cases which he had reported on a former occasion,* one in a man having a constant bruit, the other in a boy, in which the bruit was absent for days. In these two cases, the diagnosis of aneurism was made by several distinguished surgeons. In the case of the small boy the noises gradually ceased and now he was entirely free from them. The man had not been heard from recently, but a year after he was first seen the noise continued. Dr. Green did not see how our knowledge of aneurism could account for the symptoms in the cases he had presented previously. The boy complained of noises in the head, which could be heard objectively. These noises would exist for a day, and then be entirely absent for a time. He did not see how aneurism could account for this. A German writer had referred the cause of these objective noises to a different condition, namely, stenosis of the canal, and Richardson had spoken of the relaxation of the walls of the arteries as their cause,

*Transactions of this Society, 1878.

thus allowing the arterial walls to strike against the osseous walls.

Dr. Agnew said that the question was really upon Dr. Spencer's case, and that he did not defend the paper, but simply suggested that two years' existence did not necessarily exclude aneurism. Aneurism might be cured spontaneously by solidification. In the case of the small boy alluded to by Dr. Green, there was probably no aneurism.

OSTEO-SCLEROSIS OF THE MASTOID.

By J. Orne Green, M. D., *of Boston, Mass.*

Annie O'C., aged about 40, entered the City Hospital Nov. 4th, 1879, under the care of Dr. Geo. H. Lyman, who transferred her to me. At the time of entrance she was totally deaf, and as from ignorance communication by writing was unsatisfactory, the previous history is very incomplete, the following being all that could be obtained :

Some months before, there had been otorrhœa on the left side with severe pain in the left ear and mastoid, followed by an abcess just below the mastoid which had been opened by a surgeon. This inflammation was followed by complete paralysis of all the branches of the 7th nerve upon the same side. The otorrhœa and abcess healed, leaving the left ear totally deaf; the facial paralysis remained. Six weeks before entrance, with pain, otorrhœa began on the right side, soon followed by total deafness of the right ear, and as the pain continued she entered the hospital. She referred the disease to cold.

On admission to the hospital she appeared well, with the exception of a countenance suggestive of syphilis, but no other symptoms of the disease could be found. All the functions were performed regularly ; the pulse and temperature were normal, appetite good. The deafness was total in both ears ; all the branches of the left facial nerve were paralyzed. There was no hemiplegia. The only complaints were of pain above the right ear and over the right side of the scalp and above the left eye, and also of dizziness. Examination of the ears showed that the left membrana tympani

had been destroyed and replaced by a perfectly plane cicatricial membrane destitute of any landmarks, and adherent to the inner wall: just below the left mastoid was a large rough cicatrix in the skin. The right meatus was filled with purulent matter, and the walls of the passage were much narrowed by swelling of the soft parts; the membrana tympani had a large perforation occupying nearly the whole anterior segment through which muco-purulent discharge exuded, and within the perforation was a red and swollen membrane, thought to be the tympanic mucous-membrane. There was no swelling or tenderness over the right mastoid, but the skin of the scalp and over the left eye where the pain was referred, was extremely sensitive to the touch. Both temporal bones were apparently enlarged, the outlines of these bones being very evident to the eye and to the touch, and forming distinct, slightly raised and very hard non-sensitive tumors; this condition was most marked on the right side.

The deafness was total for watch, voice and tuning fork. She complained much of the noises in the ward, but as none existed she probably suffered from subjective noises in the ears.

She was ordered potassium iodide and morphine subcutaneously for the pain; the ear was douched twice a day with warm water, and astringents were applied to the tympanum.

It is unnecessary to give the daily reports of the patient and the daily treatment; various remedies were used for the pain, but none were of any avail except the morphine subcutaneously and painting the painful parts with a mixture of croton chloral, camphor and tincture of aconite root. Among other things tried were quinine, croton chloral, tincture of hyoscyamus and aconite, gelsemium sempervirens, but all were useless. Iodide of potassium was continued throughout, and for a time 60 grs. per day were taken without relief. The pain would vary much, being always most severe

at night, and was referred to any or all of the following places: the scalp, right and left forehead, either temple, or right mastoid region. There was extreme vertigo on sitting up.

Dr. Webber tested the reaction of the left facial muscles, and found no response to the faradic current, although they responded slightly to a powerful (12 cells) galvanic current.

December 3d, there was a line of tenderness and slight oedematous swelling extending across vertex nearly to the opposite ear, but this had disappeared by the next day; she also complained of "loud crashing" in the right ear and of great dizziness even while lying down. This same swelling and tenderness was afterwards noticed very often to follow the pain in any of the parts which have been mentioned above.

On Dec. 13th, as the pain had increased in severity, was very frequent in different parts, and as deep pressure showed a slight tenderness of the right mastoid, I decided to trephine the bone, and under ether with a trephine three-sixteenths of an inch in diameter, the mastoid was perforated, parallel with the meatus, to the depth of half an inch, without finding any cavity. With a small hand-drill, one-half the size of the trephine, the opening was continued forward towards the antrum, one-fourth of an inch further, without opening any cavity. Examination showed the whole bone throughout this depth solid, white and ivory-like. A bent probe in the meatus developed a small spot of caries in the posterior part of the tympanum towards the antrum. A carbolic dressing was applied to the wound.

Dec. 14th, the next day, there was no pain in the ear or head; all puffiness over the scalp and temporal region which existed at the time of the operation was gone.

From this time the patient reported herself as better; although there were recurrences of pain and puffiness in the scalp and temporal regions, these were neither so frequent,

so severe, nor of such long duration as formerly; they were, however, of the same character. There was still complaint of continuous dizziness even while lying down, and of subjective noises. The discharge from the ear gradually diminished, and by January 1st had ceased, leaving an open perforation, as I considered from the examination. The wound of the mastoid had healed. During February there were one or two attacks of pain and puffiness in the scalp and forehead, relieved by an external application of croton chloral, camphor and aconite root. On February 26th, as the patient was walking across the floor she fell suddenly, and there may have been a convulsion of very short duration, but if so, it was momentary, and the only report was from an inexperienced nurse, for when the house physician saw her she appeared the same as ever. During March there was a decided improvement in the whole condition; there was rarely any pain, and it was but slight when it was present, the dizziness was less, and on March 26th I told her she might be discharged. On the 28th in the afternoon (she having elected to wait till the 29th before leaving), she was noticed to be breathing heavily, she became unconscious in a few hours, and during the night died without convulsions, or symptoms recognized by the house physician other than a gradual diminution in the frequency of respiration.

With great difficulty permission to examine the brain was obtained, and this was done by Dr. E. G. Cutler, the pathologist of the hospital, on April 2d; the calvarium was, both externally and internally, eroded, and, in spots, partially absorbed; there were numerous small syphilitic new-growths upon the meninges; the whole brain was anæmic. Nothing in the brain explained the sudden death. The whole of the right temporal bone was removed; its surfaces, both external and internal, were normal. On opening the tympanum the mucous-membrane was found to be greatly swollen, completely filling the antrum and burying all the ossicles; the

hammer, incus and stapes were in position; no caries or bare bone existed anywhere, that felt some months before having evidently healed. The stapes was freely movable in the foramen ovale. The perforation in the mastoid was filled with a soft fibrous tissue. The membrana tympani showed a large perforation in its anterior segment just as was described from the examination during life, but instead of being still open as I supposed, was closed by a new membranous growth, which started one-sixteenth of an inch within the tympanic ring, stretched across, and was attached upon the inner surface of the true drum-membrane, thus closing the perforation tightly. Both the drum-membrane and cicatrix were enormously swollen. The osseous tympanic cavity was very small, apparently from a universal hypertrophy of the bony walls.

On sawing open the mastoid it was wholly destitute of any pneumatic cells, and consisted of extremely dense, white bone, dotted with minute reddish spots, except just at the extreme tip, where there were a very few minute cavities, not larger than pin holes, filled with soft tissue. The antrum at its mastoid end was obliterated for some distance by solid bone. The perforation made at the time of operation was plainly visible, but in its deeper part was partially obstructed by new osseous growth. The deepest point of the perforation failed to reach the remnants of the antrum by about 3 mm.

The whole labyrinth was left intact, and was placed in the hands of Dr. W. F. Whitney for preparation and microscopic examination, and it is hoped that his studies will help explain the changes which occur in the nervous structures of the ear from syphilis.

The prominent symptoms in the case were a purulent inflammation, with circumscribed caries of the right tympanum; labyrinthine symptoms, as shown by the absolute deafness and severe vertigo; the peculiar prominence of the

temporal bones: the pains in the different parts of the scalp and also in the right ear, those in the scalp being followed by puffiness of the tissues at the seat of pain, which was only of short duration, and disappeared without signs of inflammation.

At the time of operation osteo-sclerosis was expected, and before beginning the operation I expressed doubts of the existence of any mastoid cells, but from experience in cases, similar in some respects to this, I had seen such relief afforded by boring the bone merely that I did not consider a free opening into the cells absolutely necessary, although it was desirable if it could be accomplished. The autopsy showed that by a little extension of the perforation the antrum would have been reached. After penetrating the bone to the depth of a little less than 2 cm. without reaching any cavity, I desisted from further boring. After the operation the pain was much less than before, although it continued at intervals for a long time.

In only one other case have I ever seen the peculiar prominence of the temporal bone which was present here. Some two years since I was called to see a married woman, aged about thirty, who was suffering from a chronic inflammation of the left tympanum, with perforation and a polypus of the tympanic mucous-membrane; with this there was intermittent severe pain in the mastoid and over the left side of the head. The whole temporal bone of the left side was distinctly prominent, exactly as in the case now reported, and there was very slight tenderness of the mastoid on pressure. The left ear was totally deaf, and there was vertigo of moderate severity; there was never, however, when I saw her, any puffiness of the tissues. By removal of the polypus and treatment of the tympanic inflammation she made a slow recovery, the perforation healed, and the enlargement of the temporal bone diminished, but did not disappear entirely. She was under observation for six

months after recovery, and continued well, the ear however being totally deaf. In this case there was no history of syphilis, none of its symptoms, and no reason to suspect it. The question of operation here was considered, but, as the patient was six months advanced in pregnancy, it was decided to reserve it as a last resort.

Another case in which osteo-sclerosis existed, and was proven by operation, was that of a man seen in 1878. He was about thirty-five years of age, previously healthy; one week before he began to have pain in the left ear, followed by discharge two days after, and severe vertigo with vomiting and great weakness; there were also subjective noises as of hissing. Examination showed purulent inflammation of the tympanum with a minute perforation, which was enlarged with a paracentesis needle so as to give free evacuation. A few days after there was a slight paralysis of the left facial nerve. The inflammation of the tympanum subsided under treatment, the perforation healed, the paralysis disappeared, and at the end of two months the ear was apparently well, but the deafness was absolute on that side. Pain in the mastoid and over the side of the head continued, however, with slight tenderness of the mastoid on deep pressure, but without any swelling of the soft tissues; no enlargement of the bone was perceptible. Other means failing to relieve the pain, the bone was perforated under ether with a triangular borer to the depth of one-half an inch; no pneumatic cells were reached, the bone throughout being dense and ivory-like. The relief from the operation was gradual but decided, and the patient made a good recovery. In this case also there was no reason to suspect syphilis.

In 1876, at the meeting of the International Otological Society,* I reported four cases in which the operation of

*Report of the First Congress of the International Otological Society. New York: D. Appleton & Co. 1876.

trephining proved the existence of hyperostosis of the mastoid, and those cases were reported as a contribution to the clinical history of a disease of the bone, of which but little had been written. In those cases, although the bone was very much thickened, the mastoid cells had not been obliterated as in each case they were opened, although with difficulty. The three cases reported in this paper are further contributions to the same subject, showing a much greater degree of hyperostosis than existed in the former series of cases. In some remarks upon the cases I then wrote as follows: "At a meeting of the Paris Academy of Sciences in 1875, Prof. Gosselin read a paper on 'Osteo-neuralgia of the Long Bones,' in which he advocated trephining in all cases of diseased bone, whether inflammatory or neuralgic, in order to relieve the pain, if not to cure the disease. From the cases of hyperostosis which have been reported (previously), and from my experience in these (four) cases I think the same rule could be applied to the inflammatory diseases of the mastoid bone. Of ten cases of mastoid hyperostosis with which I am familiar, and in which the bone was perforated, nine were relieved, and the tenth case proved to have a necrosed sequestrum not loosened. In five of these cases the operation was followed by relief to pain and other severe symptoms within a short time (one to three days), while in the other four the relief was more gradual." My experience since is confirmatory of the favorable effect of the operation, although I would not be understood as favoring surgical interference until other means had failed.

In an article by Hartmann in the Archives of Otology, December, 1879, he apparently arrives at much the same conclusion when he says that sclerosis can appear as an idiopathic disease of the mastoid process, after cessation of inflammation of the middle ear, and cause the most vio-

lent pains, and practice proves that the symptoms of violent pains in connection with idiopathic sclerosis can be relieved by boring into the mastoid without opening a cavity or evacuating any secretion.

DISCUSSION.

Dr. Mathewson remarked that he had been very much interested in the paper of Dr. Green. He had had a case which he had temporarily relieved by an operation; it was reported to the Society in 1875. The man passed out of his hands and after a while got well. No history of syphilis was given, nor were there reasons to suspect it.

Dr. J. O. Green inquired if any members of the Society had adopted Schwartze's operation, doing the whole operation by means of gouges.

Dr. Herman Knapp said that he had done that years ago, but that he used a drill now. When a drill was used you could stop it whenever you wished by placing a mantle about the drill; but when the bone was brittle and he was drilling without a mantle he felt rather timid.

Dr. Agnew said that he had twice trephined where he found this eburnation or closure of the mastoid cells, the result of inflammation. He used a gimlet, by means of which he evacuated the pus; a fistulous opening remained. A year afterwards the patient came into his hands and ordinary therapeutic measures failing, he operated by following the fistulous opening and then drilling in. This was done under ether. Partial relief was afforded. In view of the fact that the patient was under the influence of the anesthetic for a long time, it had occurred to him that possibly the anesthetic might have had something to do with the cure of the patient. In the case of Dr. Shrady, his ear trouble began with what was thought to be nasal catarrh going on to rupture of the drum. As the case progressed, numerous con-

sultations were held, with the main object to determine the meaning of the extreme neuralgia in the mastoid, and neighboring parts; the pain was certainly very severe. Dr. Agnew was called in to consider the subject of trephining, and voted against it. About that time Dr. Loomis was called in, who recommended large doses of whiskey. More than a pint was given that afternoon and evening. This was continued for several days apparently with great improvement. It had occurred to Dr. Agnew, that where trephining does not evacuate matter, the value of the anesthetic should be taken into account as a factor in the relief of pain; he merely mentioned this. Whether the concurrent use of the anesthetic, in the case under consideration, had anything to do with the cure of neuralgia, he was not able to positively state.

Dr. J. O. Green considered the suggestion an extremely interesting one, and that it should be borne in mind. The first point would be to look at the literature, and see if anesthetic had always been used in the cases which were reported as relieved by operation. He considered Dr. Shrady's case very interesting.

Dr. Spencer remarked that he could add something having a bearing upon the influence which alcohol and anesthesia might have upon these cases. Two years ago he operated in a case where he suspected this condition of the cells. In his case he did not use the drill over the mastoid, but attempted to operate through the meatus. Profound anesthesia was produced, and though he did not accomplish all he hoped for in the operation, the patient was relieved entirely of the pain.

Dr. Sexton inquired of Dr. Green, what importance he attached to the symptom of pain in regard to the changes taking place.

Dr. J. O. Green said that he would attach a great deal of importance to this symptom in this relation.

Dr. Sexton remarked, respecting the case alluded to by Dr. Agnew, that the gentleman—Dr. Shrady—had consulted him some months previous to the attack of otitis med. pur. acuta, for an anomalous condition of the external meatus with excessive secretion of cerumen, a condition believed to arise from the irritation of carious teeth, etc. The doctor had suffered from neuralgia, depending on the irritation of the dental filaments of the fifth pair of nerves. Attention was called to the necessity of attending to this, but the advice was believed not to have been heeded. The subsequent neuralgia from which the patient suffered so much during the progress of the middle ear trouble, Dr. Sexton believed was due in great measure to the sympathetic irritation in the mouth.

Dr. Pomeroy remarked that he was not clear in regard to Dr. Green's views respecting the mode of reparation of the drum membrane which he had exhibited to the Society.

Dr. Green said that the point was in regard to how the healing process had taken place. Instead of the healing process beginning at the edges of the membrane, as is usual, it had started from the anterior part of the tympanum nearly $\frac{1}{16}$ inch within the perforation, and from there extended to the centre of the drum membrane on its inner surface.

Dr. Pomeroy said that he had observed the healing process in these perforations many times, and in describing it to his class, he had frequently compared its appearance to the patch applied beneath a hole in a garment. This method seemed to be very frequently applied in repairing the drum membrane, and he thought it to be the usual mode of healing.

Dr. Green remarked that he would refer that appearance to the collapse of the edges.

Dr. Pomeroy said that he simply referred to the appearance from inspection.

ON THE EAR AFFECTIONS OF INHERITED SYPHILIS.

By Charles J. Kipp, M. D., *of Newark, N. J.*

Although it has been known for a long time that deafness occurs not unfrequently in young persons affected with congenital syphilis, our knowledge of the clinical history and the pathology of this ear disease is as yet so imperfect that the following histories may not be devoid of interest:—

Case I.—Fannie H., aged 4, a well developed girl, apparently in excellent general health, came under my care in September, 1876, for parenchymatous keratitis, complicated with iritis of both eyes. The child's father denies having had syphilis. The mother is apparently in good health, but has a large ulcer over the tibia of right leg, and admits having had some symptoms of secondary syphilis. Excepting a marked flattening of the nose and very irregular and ill-formed teeth, there is nothing about the child to arouse suspicion as to the presence of inherited syphilis. The child received the usual local treatment of instillation of sulphate of atropia solution, and warm water applications, and took for a long time small doses of hydrargyrum c. creta, then iodide of potassium, iron and cod liver oil. During the summer the child was in the country.

About two years and a half after I first saw the patient, and while she was still under treatment for the disease of the cornea, which was slowly clearing up, she was suddenly seized with such severe pain in the back of the head and vertigo, that she was compelled to take to her bed. On the

morning of the third day of this attack a decided impairment of hearing was noticed, which increased so rapidly that by night it was necessary to shout into her ears in order to make her understand. I did not see the girl till a few weeks after this attack, but the correctness of the above details are vouched for by the father. The child had no pain in her ears, and no fever or vomiting during the attack. A few days after the sudden loss of hearing a slight watery discharge from right ear was noticed, but this ceased in less than a week. When the child was brought to me she was unable to hear the tick of my watch (of 150 cm. normal hearing distance) with the right ear, but with the left ear she heard it when pressed against the auricle. She could hear only very loud speech. The tuning fork she heard a short distance from ear with the left ear, but not with the right. When placed on vertex or glabella, or on either mastoid process, it was heard equally well with both ears.

The drum-membrane of right ear was collapsed, but could be lifted from promontory by exhausting the air from Siegle's speculum, a procedure which caused great dizziness. The Eustachian tube was very permeable, and inflation by Politzer's method caused the drum-head to become convex. In the left ear the drum-membrane was dull, moderately opaque, and sunken, but its mobility was not much impaired. The tube of this side was also open. The child had also some naso-pharyngeal catarrh. I treated the ears by Politzer's method, and applied a solution of the nitrate of silver to the pharynx several times weekly for a long period, and at the same time gave her iodide of potassium in increasing doses, but all without the slightest benefit. During the past year she has complained much of tinnitus aurium, and also of vertigo. Her hearing is even worse than two years ago, and her sight is considerably impaired by corneal opacities.

Case II.—Josephina K., aged 13, came under treatment for parenchymatous keratitis of left eye in January, 1879. The girl was very dull and listless, but apparently in tolerable health. On both sides of her neck she had large scars, and her superior incisor teeth were conical, but not notched. Her father has had syphilis. Her mother is dead. A sister of this patient has also been under my care for the same eye disease. The local and general treatment of the eye affection was the same as in the previous case. In March of same year the right eye was also attacked by parenchymatous keratitis. In May she commenced to complain of vertigo and tinnitus, and a slight impairment of hearing became manifest at same time. In October the girl became suddenly so deaf that her stepmother had much difficulty to make her understand loud speech. The girl was brought to me immediately, and on examination I found that she could not hear the tick of my watch with either ear. The tuning fork was heard when held close to either ear. Bone conduction good. Could hear only very loud speech in either ear. The drum-membrane of right ear was opaque and very concave, the end of handle of the malleus apparently resting against the promontory. The mobility was somewhat impaired. The Eustachian tube was open. No signs whatever of inflammatory trouble. The membrana tympani of left ear was of a slightly yellowish hue and collapsed. The tube was very open. Inflation of middle ear caused bulging of drum-membrane. In the upper part of pharynx adenoid vegetations were found, and the lining membrane of nose was swollen. The vegetations were crushed, and applications of a solution of nitrate of silver was made to the nose and pharynx. The middle ear was inflated by Politzer's method, and iodide of potassium was administered internally. At first there was apparently some slight improvement produced by treatment, but at present she can hear only very loud speech, and suffers much from vertigo and tinnitus. Very

lately she has passed through a mild attack of purulent inflammation of the left middle ear, with perforation, which has still more impaired the hearing of this side. Both corneæ are so opaque that she is unable to read.

Case III.—Annie V., 17 years of age, a domestic, large and stout, with very pale complexion, came under observation in December, 1874. Her parents are dead. She is an only child. Patient is in good health. Upper teeth are all gone. Some months ago she became suddenly deaf, and had at same time tinnitus aurium, vertigo and staggering gait. Deafness and tinnitus continue. Does not hear tick of watch with either ear. Hears only very loud speech. Bone conduction good. Both drum-membranes are moderately opaque and sunken. Mobility normal. Tubes permeable. Sounds dry. Has some naso-pharyngeal catarrh. She was treated by inflation of the middle ear, and applications to pharynx. She derived no benefit whatever from treatment. In July, 1879, I saw her again, on account of a very severe vascular parenchymatous keratitis of left eye. During this attack she suffered much from vertigo. A rather dense opacity of cornea remains. The other eye is as yet free from disease.

Case IV.—Mary B., aged 18, a slightly built seamstress, came under my care in May, 1874, for parenchymatous keratitis of both eyes. Her father confesses to having had syphilis in his youth. One of the girl's brothers has also been under my care for a very severe parenchymatous keratitis of both eyes. This patient was treated with iodide of potassium and iron for a long time. In December, 1879, she became suddenly very deaf, and had at same time tinnitus aurium and vertigo. Has a mild form of naso-pharyngeal catarrh. Drum-membranes are opaque and sunken, but movable. Tubes are permeable. Cannot hear tick of watch with either ear. Bone conduction satisfactory. Hears only very loud speech. Treatment: inflation of mid-

dle ear through catheter. Applications to pharynx. No improvement after six months.

Case V.—Martha M., aged 6, was brought to me in March, 1875. She had parenchymatous keratitis of both eyes, and was very deaf. For several months the child has had off and on nausea or vomiting in the morning, and has complained much of frontal headache and sleeplessness. Three weeks ago she became suddenly so very deaf that she could hardly distinguish the loudest speech. At the same time there was marked disturbance of equilibrium. The drum-membranes were almost normal in appearance, and the Eustachian tubes were permeable. Inflation by Politzer's method caused some injection of drum-membrane, but no improvement in hearing. There was some slight naso-pharyngeal catarrh. She was put on iodide of potassium, iron and cod liver oil. Fifteen months later there was still some keratitis, and her hearing was slightly better in the right ear, but there was no improvement in the left.

Case VI.—Cora C., aged 8, I saw with Dr. Wm. Rankin at the Newark Charitable Eye and Ear Infirmary. While under treatment for parenchymatous keratitis of both eyes, she suddenly became very deaf in both ears. According to her mother's story, she heard well on going to bed one night two weeks before we saw her, but could not hear loud speech next morning. She has much tinnitus, is very dizzy and staggers in her walk. She can hear only very loud speech with either ear. The examination with the watch gave unsatisfactory results, as she claimed to hear the tick when the watch was stopped. Bone conduction good. The drum-membranes were slightly retracted, somewhat dull, and the vessels along the handle of the malleus were slightly injected. The tubes were permeable. Has some naso-pharyngeal catarrh. The child's mother has had syphilis. Treatment consisted of inflation of the middle ears by Politzer's method, and the administration of iodide of iron and iodide

of potassium. Under this treatment some improvement of hearing has taken place, but the vertigo and disturbance of equilibrium are more marked now than at first. The corneæ are gradually clearing up.

Analyzed with regard to the sex and age of the patients and the symptoms presented by them, the above histories show that the patients were all girls, aged respectively, 6, 6½, 8, 13, 17 and 23 years, at the time the impairment of hearing became manifest. Parenchymatous keratitis of both eyes preceded the ear disease in five cases, and in one case this eye disease followed the ear affection. *A very marked impairment of hearing of both ears unaccompanied by earache, came on very suddenly* in five of the cases. In the sixth case the impairment of hearing which had existed for a few months, was suddenly much increased. Symptoms of cerebral irritation preceded the loss of hearing in one case. Tinnitus aurium, headache, vertigo and disturbances of equilibrium accompanied or followed the attack in all cases. Marked changes in the appearance and curvature of the drum-membranes were present in only three cases; in one case there was moderate hyperæmia of the membranes, and in the remaining two cases the drum-heads were normal. The Eustachian tube was permeable in all cases. More or less naso-pharyngeal catarrh was present in all cases.

Compared with the clinical history of this disease as given by Wilde, Hutchinson, Hinton, v. Tröltsch, Knapp and others, the above cases present all the features regarded as characteristic of this affection, except a marked discrepancy between the aerial and bone conduction of sound. But as my patients were not remarkable for their intelligence it is not improbable that they mistook vibration for sound.

The appearance of the drum-membranes found in four of my cases makes it probable that the impairment of hearing was at least in part dependent on catarrhal disease of the

middle ear, although I have found as marked physical changes of the drum-heads in the great majority of young people whose hearing was not noticeably impaired, but who had parenchymatous keratitis and other symptoms of inherited syphilis. But as catarrh of the middle ear does not ordinarily produce so great an amount of deafness in so short a time, we must assume that a disease either of the labyrinth or of the acustic nerve existed, either of which would account for the Ménière's symptoms. That a morbid process should be developed simultaneously in both labyrinths, which, as Von Tröltsch has pointed out, are so independent of each other as regards their blood supply, is, of course, not an improbability, but it seems to me that the simultaneous impairment of hearing of both ears can be more readily accounted for by the assumption of a lesion in the floor of the fourth ventricle, from which both nerves arise.

Treatment was of but little benefit in all except one case, and this result cannot be said to be entirely due to unfavorable hygienic surroundings, as several of these patients, although poor, lived in comfortable houses, and had a sufficiency of wholesome food. The treatment was chiefly directed to the disease of the middle ear and the naso-pharyngeal catarrh. Mercury was administered in but one case, but the iodide of potassium was given in all.

For the literature on this subject I would refer to Dr. Knapp's paper in the Archives of Otology, Vol. ix, No. 2, page 146.

DISCUSSION.

Dr. Agnew wished to ask the author of the interesting communication whether, in the treatment of these cases, he used mercury?

Dr. Kipp replied that he did give in one case hydrargyrum cum creta. He had for some reason been afraid to use it in children.

Dr. Agnew recommended its use in these cases as mercury was more innocuous in children than in adults. He was not a pathologist, and he could not throw any light upon the subject from actual examination. He thought the idea of a central affection did not throw any light upon the explanation. One of the most striking effects of syphilis, whether acquired or inherited, was its effect upon the tissues. He thought we must always look for changes in tissue building for the morbid phenomena, and it occurred to him in this case where there were evidences of phenomena which commonly show themselves in inflammatory affections of the drum, whether there was not some concurrent lesion in the labyrinth, analogous to the rapid changes which we see occurring in the anterior chamber of the eye, in which simultaneous keratitis goes on in children having hereditary syphilis; of course in keratitis, the trouble occurs first in one eye, but it seems that it may occur sometimes explosively in both eyes. The intense deafness may come on in the night, or there may be a slight degree of deafness, so that the parents do not know whether the child is deaf, obstinate or despondent; therefore, he said, might there not be some disturbance of tissue building due to hereditary syphilis?

Dr. Agnew further said that syphilis usually affected only one testicle, but there were cases where both were affected, and he would like to try rapid inunction and would not hesitate to carry out this treatment in the case of a child.

Dr. Sexton inquired the syphilitic affection referred to by Dr. Agnew.

Dr. Agnew said that he referred to epidydimitis.

Dr. E. Williams, of Cincinnati, remarked that the subject under consideration was of special interest to him. It was a curious fact that the eyes appeared to be much more frequently affected than the ears. This might be actually so or not, for it was well known that persons might have trou-

ble with the ears and become deaf without consulting a physician; there might be many cases of total deafness occurring which were not reported to the profession. The simultaneous occurrence of the disease in both ears, does not prove anything as to the specific character of the disease, for we all know that we have specific keratitis occurring in either one or both eyes. Some twelve years ago he treated a little girl who had characteristic teeth and symptoms, where he had no doubt of constitutional syphilis affecting the child in the form of inflammation, first of one cornea, and then the other; and which recovered completely, the patient now seeing well. Perhaps some twelve or eighteen months after recovery, she returned, complaining of a noise in both ears. He treated her to the best of his knowledge, but the patient became totally and hopelessly deaf. He was waiting for her to die for a post-mortem, but as she was only twenty, and he was twice that age, he feared the chances for his making an autopsy were not very good.

Dr. Knapp thought that simultaneous affections of both ears were not to be compared with affections of the eyes. In cerebro-spinal meningitis blindness was frequently unilateral, deafness always, as far as his experience went, bi-lateral. There must be a much more intimate connection between the two ears than the two eyes. By injuries the very same lesions were often produced in both petrous bones. He had reported some typical cases, and given an extensive bibliography on the subject under consideration in a paper recently published in the Archives of Otology.

In regard to treatment, he considered mercury infinitely better than iodide of potassium.

Dr. John Green suggested that cases of aural disease, causing deafness upon one side only, are very apt not to be brought to the notice of the surgeon. Again, some cases pass for simultaneous deafness upon the two sides where, in fact, it is consecutive. In regard to choroidal affections as a

result of cerebro-spinal meningitis, he would say that all the cases which had ever come under his notice had been binocular. Dr. Kipp's paper brought to mind a case of interstitial keratitis of both eyes, occurring in a child which he had treated with a good result. Three years afterwards the child was brought to him again, having recently become totally deaf. In this case it had been impossible to make out with certainty whether the attack had been simultaneous or consecutive in the two ears. Anti-syphilitic treatment was carried out for several months, but with no effect. In her former trouble the disease had progressed most favorably under small doses of mercury.

Dr. J. Orne Green considered the idea which Dr. J. Green had called attention to exceedingly interesting, and it was a point which should be determined whether the eyes were more frequently singly affected than the ears.

Dr. Knapp remarked that one-sided blindness was not so apt to be noticed as one-sided deafness, for instance, one-sided blindness from glaucoma simplex, had often, only accidentally been discovered, whereas people who are deaf on one side, are much more inconvenienced, and constantly have to turn their head in conversation.

Dr. Blake said that in New England five or six years ago an epidemic of cerebro-spinal meningitis occurred. He saw forty-one cases of deafness resulting from this disease, and in all both ears were affected.

Dr. Kipp remarked that he had stated that in all cases, except one, keratitis had existed in both eyes, before the ears were affected, and in one the keratitis followed the ear disease. In regard to the case referred to by Dr. Knapp, it occured to him that the similarity was distant.

Dr. Agnew advised the heroic use of mercury; he would use it so as to get its full effect in forty-eight hours or three days by inunction. Reserving the function of the stomach for nutrition.

Dr. Sexton said that since the publication of his paper on sudden deafness due to syphilis, which had excited discussion in regard to the location of the lesion, he had seen several other cases, and he would state that in all of them he had had the patients talk and sing, and had found that they could hear themselves sing, as well as talk correctly, and he had recognized the fact that they could sing in tune. These observations were rather confirmatory of the opinion that he then expressed, that the chief lesion was in the middle ear.

Dr. Knapp said that he could not coincide with the views of Dr. Sexton, for reasons which he had stated in his paper mentioned before.

Dr. Agnew thought that in cases of double deafness the disease was not confined to the middle ear. He thought that there was no case of double deafness in which the lesion was confined to the middle ear. If double deafness existed, it must involve the labyrinth.

Dr. Sexton remarked that in two or three of his cases the deafness was what might have been called total; as the patients could not not understand anything said to them, nor could they distinguish between high and low tones. He wished to put it on record that they could hear their own voices in speaking and singing almost perfectly.

Dr. Pomeroy wished to bear testimony on that point; deafness to external sounds being complete, if the patient could sing a tune through correctly, the ear trouble must be external to the labyrinth.

Dr. Blake cited a case, where the patient had been a deaf mute for fourteen years, consequent upon an attack of scarlet fever. Hearing tests being applied, it was determined that the patient heard absolutely nothing. The patient was now subjected to the influence of the galvanic current, and the tests repeated; still there was no hearing. This patient was placed under the instruction of Prof. Bell; and was taught to speak within three months; and three months

afterwards Dr. Blake heard her sing, "God Save the Queen."

Dr. J. Orne Green felt perfectly sure that he had heard singers say that singing was muscular; it was mechanical, and until it became mechanical they could not be experts.

Dr. Sexton inquired if the patient referred to by Dr. Blake could hear her own voice.

Dr. Blake replied in the negative; but remarked that the patient said she could feel what she was saying in her throat.

Dr. Sexton doubted very much whether any person ever learned to talk intelligibly, who had never heard their own voice.

Dr. Blake remarked that as far as he could determine the patients referred to did not hear their own voices. The instruction had to be kept up in order to keep up the modulation of the voice.

ON BRANCHIAL FISTULÆ AT THE EXTERNAL EAR.

By Charles J. Kipp, M. D., *of Newark, N. J.*

During the last few years I have seen six individuals in whom this anomaly, or a depression in the skin corresponding to the usual seat of the orifice of the fistulæ, was present. Four of these persons were males and two females. In five a fistulous canal, into which a fine probe could be passed in a downward, forward and inward direction, for a distance varying from three to ten mm., was found on the helix, about a cm. above the upper end of the tragus. In three of these persons the anomaly existed on both ears, and in two on one ear only. An occasional discharge of a milky fluid from the orifice of the fistula had been noticed in four of these cases, and in three of the latter a cyst, which communicated with the fistula, was found in front of the tragus. In one of the cases of bilateral fistulæ, the skin in front of both ears was of a peculiar, cicatricial appearance. A small, but deep depression in the skin was found on the helix of both ears in one case. None of these six persons presented any other abnormity about the auricles, and in all the external auditory canal and the tympanic cavity appeared perfectly normal. The hearing power was normal in all except one case, in whom the impairment was caused by an acute catarrh of the middle ears. Hare-lip, cleft palate, or other deformities of face and mouth, and fistulæ of neck existed in none of these individuals. In all the anomaly was noticed shortly after birth.

Twice this fistula was found in two children of the same

family. In the one instance a girl had bilateral fistulæ, and a boy a fistula on the right ear only. In the other instance the brother had a dimple on the helix of both ears, and the sister had a fistula on the helix of the left ear only. The parents of these four persons, and also those of the fifth case, and their other brothers and sisters, did not present this anomaly. No information could be obtained as to the parents of the sixth patient.

In none of these cases was it possible to demonstrate a connection between the fistula and the external auditory canal or the tympanic cavity, either by injections into the fistula or by inflation of the middle ear. The entirely healthy condition of the tympanic cavity in all the cases with secreting fistulæ, furnishes, I think, additional evidence that they did not communicate.

Considered from a surgical standpoint, three of the cases are of considerable interest, on account of the cysts which were found in connection with the fistula. The first of these cases was a young woman with a secreting fistula at the left ear and a dry one on the right. The swelling made its appearance in front of the left tragus about a month before I first saw her. Since then it has steadily increased in size, and has also become quite painful. The tumor is now about the size of a hazel nut, and the integument over it is red and hot. Fluctuation is well marked. Efforts to evacuate the contents of the tumor having failed, I made a small incision in its most dependent part, and evacuated a considerable quantity of puriform fluid. The incision healed in a few days, but reopened a week later, and after discharging for some days closed permanently. Since then there has been no return of the tumor. Shortly after the evacuation of the tumor, a probe could be passed through the fistula into the sac.

The second case occurred in a boy, who presented himself with the following history: About a year ago a swelling

developed in front of the tragus of the left ear and was incised ten months later, since which time there has been a discharge from the cut. On examination I found in front of the ear a large, collapsed, subcutaneous cyst, in the anterior wall of which was an opening about a cm. in length. On the helix of this ear was the orifice of a fistula, through which a probe could be passed into the cyst. The inner surface of the sac was smooth and shining, and the secretion from it was thin and glairy. I enlarged the opening, and applied lunar caustic freely to the inner surface of the cyst. The cauterization was repeated at short intervals, and had caused a considerable diminution in the size of the cyst when the patient was last seen, two weeks later.

In the third case a cyst, measuring about twenty-five mm. in length and width, was found in front of the tragus of the right ear, and a fistula immediately in front of the helix of both ears. The integument over the tumor was of livid hue. According to the patient's statement, the tumor was first noticed about nine months before I saw him, and was incised about six weeks later. About two months after that the tumor was larger than before it was cut. Since then poultices have been applied in the hope of bringing the swelling to "a head." As the contents of the tumor could not be forced out through the fistula, and the outer wall of the cyst was extremely thin, I split this wall from above downwards, and evacuated a considerable quantity of a yellowish, glairy fluid. The integument was found to be inseparably connected with the sac, and the inner surface of the latter was smooth and shining. Repeated application of caustics caused closure of the sac in about two months. A relapse occurred, however, in the course of a few months. The above described treatment was then again resorted to, and obliteration of the sac effected in a month. Since then there has been no return of the tumor. Before the sac was incised a probe could not be passed through the fistula into

the sac, but afterwards this could be done without difficulty.

As to the nature of these tumors there can be no doubt that they are retention-cysts (Urbantschitsch, Monatsschrift für Ohrenheilkunde, 1877, No. 7). Judging from my experience, treatment by incision and cauterization is not reliable, and should not be resorted to if extirpation is at all practicable.

Since Heusinger (Virchow's Archiv., Vol. 29, page 358) first described this anomaly, cases have been reported by Schede, Schmitz, (both cited by Urbantschitsch in Monatsschrift für Ohrenheilkunde, 1877, No. 7), Pflüger, (Monatsschrift f. Ohrenheilkunde, 1874, No. 11), Urbantschitsch (l. c.), Paget (Lancet, Dec. 1, 1877), and Schwabach (Archives of Otology, Vol. VIII, No. 3).

DISCUSSION.

Dr. Knapp said that also Dr. Urbantschitsch was of the opinion that the so-called congenital aural fistula had nothing to do with the ears as stated in Dr. U.'s recent excellent text-book, which, by the way, was the most exhaustive book for reference up to this day.

Dr. Howe inquired if Dr. Kipp had examined the Eustachian tube. He had occasion to make a number of sections in fœtuses, and as far as he was capable of judging, he should be inclined to think that examination would be quite as likely to show some malformation of the Eustachian tube.

Dr. Kipp remarked that he had stated that he had examined merely for cleft palate, hare-lip, and fistulæ of the neck.

Dr. Sexton presented two photographs bearing on this subject to the Society. In one of these cases the auricle was rudimentary and no osseous meatus could be detected. The other case was exceedingly interesting; the auricle was

folded upon itself like a rose-bud : when unfolded it had the appearance of a normal auricle. The cartilage, however, was defective, and the external auditory meatus was narrowed very much. The greatest interest in the case was found in the imperfectly closed post-oralbranchial fissure, which presented itself on the anterior-superior aspect of the helix as the auricle was spread out.

SOME REMARKS AND OBSERVATIONS ON BONE CONDUCTION.

By Dr. H. Knapp, *of New York.*

The possibility of a direct transmission of sound to the expansion of the acoustic nerve in the labyrinth through the cranial bones without participation of the sound-conducting apparatus in the middle ear, can, I think, not be denied. When we close our eyes, or when in total leucoma of the cornea, closure of the pupil, or a milky cataract, the regular conduction of light waves to the retina by the refracting apparatus of the eye is excluded, the light penetrates through the lids, the opaque parts in, before or behind the pupil, and through the sclerotic, but the visual sensation produced in this way, differs essentially from the ordinary seeing. While the latter furnishes us a clear perception of objects in all their details and relations, the former is a mere sensation of light and color. We therefore call the former qualitative, the latter quantitative perception of light. I always thought that the auditory organ, in many respects so similar to the visual, might also be similarly constituted as to quantitative and qualitative perceptions of sound. Prof. V. Hensen of Kiel, in his recent excellent treatise on the physiology of audition (Hermann's Handbuch, Vol. III., part 2, p. 26), after citing the well-known experiments with the tuning-fork, says: "The peculiarity that a tuning-fork is so well heard from the cranial bones, was originally explained by the supposition of a direct transmission of the sound-waves to the labyrinth, apparently the most favorable conditions for

an intense transmission of sound. This view can not longer be accepted." Then he mentions the experiments of Politzer, Lucæ and Schmidekam, demonstrating that a tuning-fork, held on the cranium, sets the ossicles and membrana tympani in vibration. His views are expressed in the following sentence: "As the bone conduction incontestably reaches the labyrinth to a very considerable degree through the apparatus of the middle ear, this physiological process might be correctly expressed by the term *cranio-tympanal* conduction. How far a direct bone conduction calls forth a sensation of sound is still unknown." Lucæ, in his review of Hensen's work (Arch. f. Ohrenh. XVI., p. 88), replies to this that he described (Arch. f. Ohr. I., p. 306) a case of congenital absence of the external and middle ear, in which the post-mortem examination had discovered only the acoustic nerve and cochlea in a perfectly normal condition. A table-bell (A^1) when placed on the skull of the patient was heard "very well" on the diseased side, but less loud than on the healthy. Lucæ has always considered this case as proof positive of direct bone conduction. This I will not contest, and supposing that the windows of the labyrinth were filled up with bone, then the ear would be in the condition of an eye with a closed pupil; the sound-waves would be irregularly transmitted to the cochlea, not producing the sensation of a sound-image, if you will pass me the expression, but an indefinite, i. e., quantitative perception of sound. Qualitative perception of sound means the discrimination of articulate speech and musical tones; in particular, clang-tint, melody and harmony. To produce this, I think the integrity of the sound receiving and conducting apparatus of the middle ear, especially the mechanism of the stapes, is indispensible. It may not be impossible to furnish direct evidence for this supposition, as there are many ear patients who have only quantitative perception of sound, $V\frac{1}{\infty}$, i. e., they hear voice and music, but are unable to understand the

words or recognize the musical character of the tones. Autopsies might reveal the bony clossure of the windows on both sides. My opinion, according to the foregoing course of reasoning, is that direct bone conduction does exist, but produces only quantitative perception of sound, not useful hearing.

If this be true, the part it plays in the auditory perceptions of people with perfect or impaired hearing, must be very insignificant. In support of this supposition I can mention the following observations :—

1. *I have never met with a person who could hear my watch* (H. D.=24″) *from the mastoid process, temple or other parts, if he could not hear it on application to the ear.* For some time I have paid particular attention to this point, and if the direct bone-conduction were of any importance I would have met with the one or other patient in whom my watch made an auditory impression from the mastoid, while the sound-conducting apparatus of his middle ear was so defective as to admit of none. I have met with many people who could not hear my watch in any way, without being deaf for stronger sources of sound.

2. *I have had patients with acute and chronic diseases of the middle ear that could hear my watch only on application to the auricle or not hear it at all. After I had punctured the drumhead and inflated the ear by Politzer's method, my watch was distinctly heard, not only on application to the auricle, but also from the mastoid, temple, etc.* I think this is a conclusive experiment that the immediate bone-conduction is of little or no account. Paracentesis and inflation can have an influence only on the sound-conducting apparatus, say relieve the encumbered stapes, but cannot change the condition of the mastoid process so as to make it capable of directly transmitting sound, when formerly it was not. It seems to follow that the sound-waves received by the mastoid process required the coöperation of the stapes to be conveyed to the labyrinth.

3. *I have never found a person who was benefitted more by the audiphone than by a trumpet.* This experiment is, in principle, the same as that with the watch. It shows that the tympanal conduction is more powerful than the cranial. But might not there be a person in whom the tympanal conduction sinks so low as to be at the level of the cranial? There ought to be and certainly there will be, for if the sound-conducting apparatus of the middle ear be destroyed, the anchylosed parts will still vibrate when struck by the waves of sound, and just as well as the cranial bones. If young and middle-aged persons, in whom the bone conduction may be assumed as being preserved, offer these conditions on both sides, and show only quantitative perception of sound, both by tympanal and cranial conduction, it would be proven that the cranial conduction is not sufficient for useful hearing. I have not observed such, but other cases, where, in violent bilateral otitis media, only the sound of loud-spoken words was heard, but the words were not understood. After Politzer's inflation, the patients could distinctly understand what was said. Here again the sound-conducting apparatus was clogged in such a way as to abolish qualitative perception, but the removal of the obstacles restored it. The acoustic nerves being in good condition, as the experiment showed, it was evident that the sound-waves which struck the skull were, before the clearing of the tympanum, not qualitatively perceived.

Mr. President and gentlemen, I offer these remarks as the result of a comparison between the functions of the eye and ear. The subject certainly needs a good deal of further observation. Thus far, I think that the importance of the bone conduction both from a physiological and a practical point of view, has been greatly overrated. I even can imagine that bone conduction may have a disturbing influence on hearing, just as the diffuse light which we receive through the sclerotic, iris, opacities of the cornea, etc., disturb the

vision, a fact strikingly illustrated in albinotic people. If it were possible to surround the sound-receiving apparatus in the cochlea with a material incapable of vibrating, it would be an advantage to hearing.

DISCUSSION.

Dr. Blake inquired if he was right in understanding Dr. Knapp's opinion to be that the vibration of the stapes was necessary to the conduction of sounds.

Dr. Knapp remarked that he thought it necessary for the transmission of such sound-waves as produced qualitive perception of hearing, i. e., melody, harmony, and articulate speech; just as the pupil was necessary for qualitative perception of light, i. e. the recognition of objects. Dr. Knapp thought the terminal apparatus, by mere bone conduction, did not receive regular sound-waves, "sound-images."

Dr. Blake remarked that that implied a much finer working power for the quantitative element. It was the subject that he had been studying for some time.

Dr. Knapp instanced a case of a gentleman who had an attack of pneumonia following an intense cold, and who also had a violent otitis media, and could not distinguish the loudest words. As soon as Politzer's method was used, he could. The acoustic nerves were in good condition, and the skull was sufficiently large to receive the sound-waves to be perceived, but this did not suffice. In another case the lost bone conduction was instantly restored by paracentesis and inflation of the drum, letting out puriform liquid. Paracentesis could not change the condition of the bone. He was quite sure that the bone conduction was much more a mediate than direct transmission of sound.

Dr. Blake remarked that the conduction of sound through the bones of the head was always the same, and that the rate

of readiness with which different tones were transmitted, were readily demonstrated. That being the same in all cases after the sound-transmitting portion was interfered with, the patient did not hear sounds applied to the mastoid. When the sound-transmitting apparatus is allowed to vibrate more freely a sound is heard. The argument of Dr. Knapp was that the sound was transmitted through the ossicula ultimately to the labyrinth.

Dr. Knapp repeated (as Dr. Blake had been absent during the reading of the first part of his paper), the views he held had been suggested by the physiological analogies between the eye and ear. The mere perception of light, and also of color, was possible where there was no pupil, but such patients had no useful sight; so with the ear in regard to sound, where the regular sound-conducting apparatus was destroyed, patients could have quantitative perception of sound, but no qualitative perception. As far as he had been able to ascertain, the cranial bones alone were not instrumental to qualitative perception of sound.

Dr. Blake said that he differed only from Dr. Knapp in entertaining the views that when anchylosis of the bones of the ear existed, vibration in the labyrinth was prevented; the sound was conveyed through the bones, but the parts in the labyrinth did not vibrate. So soon, however, as the sound-transmitting apparatus was relieved, so that it could vibrate, the sound was communicated to the terminal apparatus, and then the patient heard.

Dr. Knapp wished to make the point that if the oval window was immovably shut, then there could be no qualitative perception of sound, no qualitative analysis; the apparatus for it is wanting, just as the regular refracting apparatus is wanting in the eye, in the case of total leucoma or closure of the pupil.

Dr. Blake remarked that the response was to the fundamental as well as to the overtone; the sound transmitting

apparatus was loaded so that it could not vibrate; the moment the load was lifted, vibration within the labyrinth in response to tones transmitted through the cranial bones was possible.

Dr. Knapp thought the subject under consideration highly interesting. We were just at the starting-point of understanding these phenomena of sound perception. To complete the work there must be a full analysis of sound reception and transmission somewhat in the same way that we can now analyse refraction. We knew that sound-waves were not single waves, but were compound; and he thought these compound waves and their regular succession, were only transmitted by the peculiar tympanal apparatus, malleus, incus, and stapes.

Dr. Blake remarked that the point in regard to the transmission of a compound wave was a mechanical matter. If a sounding body or a tuning-fork was brought into contact with the mastoid, it might be distinctly heard by direct transmission to the labyrinth, provided that the sound-transmitting apparatus was sufficiently mobile to permit intra-labrynthine vibration.

He agreed with Dr. Knapp in the main, but thought that the quality of the sound was not entirely lost by transmission; he thought this was shown by experiments upon telephone plates; the quality while almost lost was still distinguishable. He could hardly think that the cranial bones could from their structure be able to do entirely away with quality. In this connection, he wished to ask Dr. Knapp if he had noticed that the patient's voice often possessed a characteristic symptom, and that immediately after inflation of the middle ear, the voice became more natural? This, of course, supported the point which Dr. Knapp had made, and when in his cases, this condition of things was noticed, he had tried to be particularly careful in testing the bone conduction. He thought by studying these cases in this

way, that something more might be done to clear up this subject.

Dr. Pomeroy said that there was one difficulty which occurred to him; it was well known that in chronic inflammation of the middle ear, the patient hears a tuning-fork better in the bad ear, than the unaffected one. According to the theory here advanced, the patient, under such circumstances ought to hear better in the well ear, because the vibration of the ossicles was interfered with. This puzzled him, and he asked for an explanation by Dr. Knapp.

Dr. Knapp thought that in such cases, the stapes might vibrate freely, and its vibrations be strengthened by reflection from the thickened drum-head or any other obstacle standing in the way of an easy exit of sound, according to the Mach-Politzer theory.

This fact, however, was not yet sufficiently explained, but was still a point of controversy.

Dr. Pomeroy remarked that the observation he made was exact, as his own ears were used in the test.

Dr. Blake remarked that it seemed to him that this whole matter of bone conduction must be thoroughly gone over; it was a subject of great importance, and to solve its problems fully, experiments must be made in the physical as well as in the physiological laboratory.

Dr. Andrews wished to ask Dr. Knapp if he considered cases of intermittent bone conduction excluded?

Dr. Knapp asked Dr. Andrews to be kind enough to explain the term "intermittent bone conduction" by examples.

Dr. Andrews said that he had noted thirteen cases of absence of conduction upon the application of the tuning-fork, but after inflation, conduction returned, perhaps not after the first inflation, but after the third or fourth. It seemed to him that we could only account for the absence of bone conduction in these cases upon mechanical principles. Impaction of the stapes plate in the oval window, or the presence of fluid in the tympanic cavity, exerting pressure

upon the labyrinth fluid, and thereby causing an interference with the function of the terminal fibres of the acusticus, would perhaps be a fair explanation.

Dr. Knapp inquired if the cases referred to were free from otitis media.

Dr. Andrews remarked that necessarily they would have otitis media. He remarked that labyrinth disease was not common. In Vol. 1, of the "Archiv für Ohrenheilkunde," Politzer has described a case in point, which seemed to him conclusive; In a girl fifteen years of age, with an acute otitis of both middle ears, the conduction of sound of tuning-fork was completely obliterated; after inflation, conduction on the left side was normal, but did not return on the right side until the ninth day. In the left ear, Dr. Andrews considered the absence of conduction due to the presence of fluid in the tympanum.

Dr. Pomeroy thought it would have to be admitted that there was pressure upon the oval window. Numerous cases were recorded where there was no sound heard before inflation, but heard afterwards. He thought that pressure interrupted the function of the acoustic nerve.

Dr. Knapp remarked that it was just here that he could not agree with Dr. Pomeroy. If you press upon a nerve you cannot restore its function at once, by removing the pressure; so he thought that by one blow of air the function of the nerve would not immediately be restored. Inflation acted by the removal of a mechanical encumbrance from the ossicles.

Dr. Pomeroy called attention to the fact that the eye recovers its function in a minute or two after the removal of pressure.

Dr. Knapp acknowledged this to be so in cases where the pressure was of short duration, but declared that inflation produced hearing momentarily, even as in cases of inflammation of long standing. Any nerve subjected to prolonged pressure, did not so soon resume its function.

VERBAL COMMUNICATIONS.

EXHIBITION OF PATHOLOGICAL SPECIMENS.

Phlebitis of the Lateral Sinus, and Mastoid Emissary Vein on that side—By Dr. J. O. Green, Boston, Mass.

The case had been reported in the American Journal of Otology.

There was nothing specially interesting except as confirmative evidence that tenderness over the vein was due to inflammation of the vein, and that the inflammation was due to trouble in the lateral sinus. It was the first time he had been able to confirm this diagnosis. The symptoms throughout were those of pyæmia. Chills, a variable temperature, and tenderness over the emissary vein, were about the only symptoms. Patient died in three weeks of pyæmia, with emboli in the lungs and deep suppuration in the neck. The temperature had been taken at intervals of two hours for three weeks and it had been found to vary between two successive registrations as many as four or five degrees. The specimen showed the lateral sinus very distinctly, as well as the discoloration. Upon dissecting up the scalp from the skull, he came upon the spot of inflammation in the emissary vein.

Necrosis Involving the Inner Table of the Mastoid—By Dr. J. O. Green, Boston, Mass.

The case was one of chronic otorrhœa, of one year's duration, following typhoid fever; with a fistulous opening through the mastoid, involving the inner table of the mas-

toid. The operation was not followed by a single bad symptom, and on the morning following, the patient, (a female), was up and about. She was kept quiet for twenty-four hours; a carbolic acid wash was used.

Exfoliated Pieces of an Osseus Labyrinth—By Dr. C. J. Blake, Boston, Mass.

The specimen presented was from a patient brought to the Eye and Ear Infirmary; a man seventy years of age, with purulent inflammation of the middle ear; the case had been reported in the American Journal of Otology. The dead bone was removed through a large perforation of the membrana tympani. The first piece of dead bone was a portion of the cochlea; the second included portions of the semi-circular canals. The specimens were exhibited because, since the publication of the case, the patient had considerably improved, and the interest of the case was correspondingly enhanced. At present the patient had no discharge whatever from the middle ear, the ear being quite dry and the perforation closed, and the facial paralysis, which had been considerable, had greatly improved. The case was remarkable, in view of the good recovery made at this age, and of the fact that during its progress, the patient had very little pain.

Exostoses in the Earcanals of Moundbuilders.—By Dr. C. J. Blake, Boston, Mass.

Dr. Blake next exhibited a drawing representing an exostosis of the external auditory canal. Dr. Blake remarked that the number of prehistoric crania in this country is very large; and that he had been very much interested in the study of this condition in these cases. Last summer he had the opportunity of examining one hundred and ninety-five crania from the mounds of Tennessee, and over one hundred crania of the California Indians after contact with the whites;

these being examined with the object of determining whether the mound-builders suffered from syphilis. One peculiarity noticeable in these ears was the shape of the external auditory canal, the anterior diameter being longer in proportion than the horizontal diameter; much greater than in Europeans; and this peculiarity coming out so distinctly had suggested a relationship between this form and the occurrence of exostosis. In all there were forty-seven cases of exostosis, and among these there were some of the most remarkable instances of exostosis that he had ever seen. In one specimen there was an unusually large exostosis in the posterior wall; and upon the anterior wall a peculiar nipple-shaped exostosis. In conversation with Dr. Green, of Boston, in reference to these crania, that gentleman brought up the question of purulent middle ear disease; and since then, whenever it was possible, Dr. Blake had examined the middle ears. These crania, he stated, were in a good state of preservation. The external auditory canals were always found full of earth, and on removing this there was usually found but little destruction of the bone, and in many of these cases he had found the ossicula and got them out. In none of them had he found evidences of long continued disease of the middle ear. He hoped to continue his observations upon these crania.

Dr. Pomeroy inquired about the evidences of syphilis in these crania.

Dr. Blake replied that so far as he had been able to ascertain, there were no evidences to indicate syphilitic disease among the mound-builders. The examination of the crania of the California Indians after contact with the whites, was made for the purpose of comparison; but in these crania, something over a hundred in number, he found no evidences of syphilis. He called attention to the evidences which he found in certain cases of rheumatic arthritis, the bones showing that their owners had had injuries or suffered from

the disease in childhood, and had grown to middle age. Evidences showed that these people kindly cared for their sick.

Dr. Webster inquired of Dr. Blake if he had any idea in what proportion of cases exostosis would be found in the skulls of the last hundred years.

Dr. Blake replied that he thought that the proportion was smaller now, but suggested that the integument might cover small exostosis so that they could not be recognized during life. He could not say why it was that there were now a smaller number of cases of exostosis than occurred among the mound-builders.

EXHIBITION OF INSTRUMENTS.

Modification of Politzer's Air Bag.—By Dr. J. O. Green, of Boston, Mass.

Dr. Green said he had often been incommoded by the bulk of the Politzer bag, and had lately succeeded in making a modification, which allowed of the bag being readily carried in the vest pocket, and which seemed to be perfectly efficient. It was of the form of a bellows, between firm but light metallic plates, which could be brought together and fastened by a hook. The expansion was produced by the pressure of a firm spring between the plates. The whole mechanism was covered with inelastic rubber cloth. A valve for filling could be inserted if desired, or the vacuum caused by expansion would readily fill from the nozzle. It was made by Leach & Greene, 1 Hamilton Place, Boston, Mass.

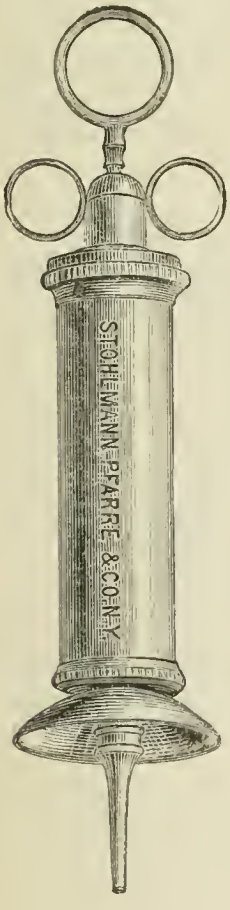
Dr. Green said that aside from its portability it overcame one disadvantage of the usual form of bag. In advising the use of Politzer's inflation at home the operation was not infrequently inefficient, from the fact that it had to be used by mothers and nurses whose hands were not large and strong enough to grasp the whole bag, and consequently the evacuation of the air was very imperfect. With this modification the thumb and finger were sufficient for evacuation, and the two plates coming into contact the evacuation was more thorough than with the usual form of bag. It could be used equally well with the catheter.

An Instrument for the removal of epithelial masses.—By Dr. E. D. Spear, Jr., Boston, Mass.—Presented by Dr. C. J. Blake, Boston, Mass.

Dr. Blake presented an instrument, devised by Dr. E. D. Spear, Jr., of Boston, Mass., for the removal of epithelial masses in exfoliative keratosis. It was a fine-toothed forceps, resembling the fixation forceps for the eyeball.

Aural Syringe.—By Dr. O. D. Pomeroy, New York.

Dr. Pomeroy exhibited an attachment to an ear syringe he had been using four or five years, which he had not thought of sufficient importance to merit making special mention of; but recently he had a case of impacted cerumen, where it was quite difficult to remove, and in which the syringe presented was a very great aid. Dr. Pomeroy stated that most syringes were constructed with a little bulb so that the syringe could not be thrust into the ear and wound the drum membrane. Another point of defect usually found in syringes for this purpose was that the opening of the nozzle was too large. For the removal of foreign bodies from the ear you must have first an instrument with a sufficient sized barrel to get up a considerable stream; secondly, the aperture must not be too large, so that a good tension of the stream can be secured; a great deal of force was sometimes necessary; third, the end of the syringe should be brought close to the object which is to be removed. The syringe recommended by Dr. Pomeroy had a long nozzle which *might* be thrust through the drum membrane, but he thought none of the gentlemen present would do that. He had found this much more effective. In the case referred to he had



tried to remove the cerumen with the ordinary syringe; failing, he tried this, and two strokes were sufficient to remove the whole of it at once. The aperture was only one millimetre in diameter, the nozzle at the other extremity being three millimetres in diameter, and the entire length of the nozzle five centimetres. There was a protective flange on the nozzle end of the syringe, five centimetres and three millimetres in diameter. The syringe is a modification of Toynbee's syringe, holds two ounces, and is made by Stohlman, Pfarre & Co., New York.

Drop Tube and Powder Blower, for treatment of the Middle Ear.—By Dr. J. A. Andrews, of Clifton, S. I., New York.

Dr. J. A. Andrews exhibited two instruments, one intended for the application of medicated fluids, and the other of powders to the middle ear. These had been described in the Archives of Medicine, Vol. III., p. 224. Reynders & Co., New York, are the makers, to whom we are indebted for the accompanying cuts.

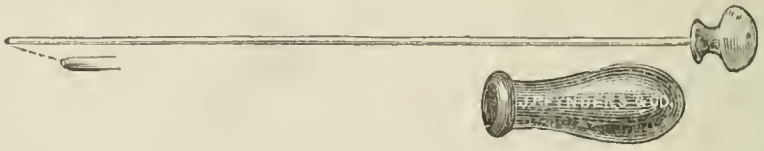


FIG. I. Tube for liquids. Diameter 1 mm.

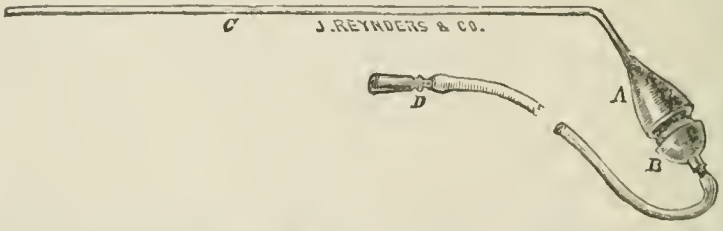


FIG. II. Tube for powders.—*C* tube, 5 min. long. Diameter, No. 5, Charrière's scale. *A B* hollow bulb about actual size. Powder is placed in *A* and the cover *B* screwed on tightly; the powder is then blown through tube with the mouth, by means of mouth-piece *D*. The mouth-piece is used instead of air-bag described in paper.

Dr. Blake remarked that he had used the instrument exhibited by Dr. Andrews, and found it very satisfactory.

ON THE USE OF COMMON SALT AS CLEANSING SOLUTION IN OTITIS MEDIA PURULENTA WITH PERFORATED MEMBRANA TYMPANI.

By Dr. J. Green, *St. Louis, Mo.*

Dr. J. Green made a suggestion favoring the more general use of a weak solution of common salt as a cleansing injection in otitis media, as being less irritating than water. He believed that the ordinary injection of pure water often did harm; oftener, perhaps, than we are aware of.

Dr. Kipp remarked that Dr. Schwartze recommended this long ago.

Dr. Pomeroy said that he had used weak solutions of common salt for some time for this purpose, and considered it less irritating than pure water; beyond this he did not look for any remedial effects.

Dr. J. S. Prout remarked that he had been in the habit of recommending Davidson's syringe for washing out the ear, as there was no possibility of injury to the drum membrane owing to the flexibility of the tube, as was the case when pressure was exerted upon the stiff hard rubber syringe.

Dr. Green remarked that the ordinary bulb syringe was probably the best.

SERIAL

RF
1
A55
v.2

American Otological Society
Transactions

GERSTS